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ABSTRACT

Seven papers from the 1987 CAUSE conference's Track II, Innovative Management, are presented. They include: "Is This Creative, or What!" (Kenneth C. Blythe); "Joint Application Design: Can a User Committee Design a System in Four Days?" (Diane Kent, David Smithers); "Making It Happen without Appropriation" (Robert E. Roberson); "Prototypes and Simulations as Decision Tools: Increasing the Software Implementation Success Ratio" (Elliott J. Haugen and Brian D. Nedwek); "Administrative and Strategic Computing" (Ronald L. Moore and Frank B. Thomas); "Stanford Jumps to the '90s--Distributed Programming, Promising or Premature?" (David J. Ernst); and "The Director Dons the Banker's Cap, or, Need a PC? Have I Got a Deal for You!" (Arthur Brooks). (LB)

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# *Leveraging Information Technology*

## Proceedings of the 1987 CAUSE National Conference

**TRACK II: Innovative Management**

December 1-4, 1987
Innisbrook Resort
Tarpon Springs, Florida

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CAUSE, the Professional Association for Computing and Information Technology in Higher Education, helps colleges and universities strengthen and improve their computing, communications, and information services, both academic and administrative. The association also helps individual members develop as professionals in the field of higher education computing and information technology.

Formerly known as the College and University Systems Exchange, CAUSE was organized as a volunteer association in 1962 and incorporated in 1971 with twenty-five charter member institutions. In the same year the CAUSE National Office opened in Boulder, Colorado, with a professional staff to serve the membership. Today the association serves almost 2,000 individuals from 730 campuses representing nearly 500 colleges and universities, and 31 sustaining member companies.

CAUSE provides member institutions with many services to increase the effectiveness of their computing environments, including: the Administrative Systems Query (ASQ) Service, which provides to members information about typical computing practices among peer institutions from a data base of member institution profiles; the CAUSE Exchange Library, a clearinghouse for documents and systems descriptions made available by members through CAUSE; association publications, including a bi-monthly newsletter, *CAUSE Information*, the professional magazine, *CAUSE/EFFECT*, and monographs and professional papers; workshops and seminars; and the CAUSE National Conference.

We encourage you to use CAUSE to support your own efforts to strengthen your institution's management and educational capabilities through the effective use of computing and information technology.

# INTRODUCTION

As professionals in an always-exciting field, we are constantly facing challenges to blend new information technologies into our institutions. It is important for higher education to develop environments that promote the use of information technology for strategic advantages, that allow faculty, staff, and students to benefit from existing technology, and that stimulate the discovery of new opportunities.

The 1987 CAUSE National Conference, with its theme "Leveraging Information Technology," offered the opportunity for us to share, exchange, and learn of new developments in information technology to improve and enhance our environments. The CAUSE87 program was designed to allow the fullest possible discussion of issues related to these new developments. Seven concurrent tracks with 49 selected presentations covered important issues in general areas of policy and planning, management, organization, and support services, as well as in the specialized areas of communications, hardware/software strategies, and outstanding applications.

To expand opportunities for informal interaction, some changes were made in the program schedule. CAUSE Constituent Groups met the day before the conference, as they did in 1986, but were given opportunities to meet again during the conference. Current Issues Sessions were moved to Thursday afternoon to provide some flexibility with time, encourage interactive participation, and extend opportunities to continue discussions with colleagues. Vendor workshops were offered for the first time this year, the day before the conference. The Wednesday afternoon schedule accommodated continued vendor workshops, vendor suite exhibits, and concurrent vendor sessions.

David P. Roselle, President of the University of Kentucky, set the tone for CAUSE87 with a Wednesday morning opening presentation expressing his commitment to the value of information technology in higher education. John G. Kemeny, past president of Dartmouth College and currently Chairman of the Board of True BASIC, Inc., spoke during Thursday's luncheon of new developments in computing for classroom learning. The concluding general session, Friday's Current Issues Forum, offered an exchange of philosophies about making optimal use of technologies on our campuses.

We were extremely fortunate to be at Innisbrook, a resort with outstanding conference facilities and great natural beauty (and weather)—a real distillation of the best of Florida.

Almost 800 people attended CAUSE87. Many of them described the conference, in their evaluation forms, as stimulating, informative, and memorable. We hope this publication of the substance of CAUSE87 will be a continuing resource, both for conference-goers and for those who will be reading about the conference offerings for the first time.

*Wayne Donald*
*CAUSE87 Chair*

# Table of Contents

**TRACK II: Innovative Management** ..... 89

*Is This Creative, or What!* ..... 91
Kenneth C. Blythe

*Joint Application Design: Can a User Committee Design a System in Four Days?* ..... 101
Diane Kent and David Smithers

*Making It Happen without Appropriation* ..... 111
Robert E. Roberson

*Prototypes and Simulations as Decision Tools: Increasing the Software Implementation Success Ratio* ..... 123
Elliott J. Haugen and Brian P. Nedwek

*Administrative and Strategic Computing* ..... 133
Ronald L. Moore and Frank B. Thomas

*Stanford Jumps to the '90s—Distributed Programming, Promising or Premature?* ..... 141
David J. Ernst

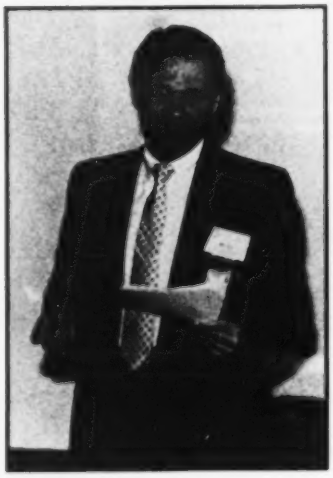
*The Director Dons the Banker's Cap, or, Need a PC? Have I Got a Deal for You!* ..... 153
*Arthur Brooks*

# Track II
## Innovative Management

*Coordinator:*
*Carole Barone*
*Syracuse University*

Papers in this track describe unusual techniques for acquiring information technology, for utilizing the technology to maintain an acceptable level of operation, or for innovative management in the academic arena or administrative areas such as finance, space management, personnel student management, and development.

***Brian P. Nedwek***
***St. Louis University***



***Ken Blythe***
***Penn State University***

***Diane Kent***
***University of British Columbia***

# Is this Creative, or What!

Kenneth C. Blythe

The Pennsylvania State University
University Park, Pennsylvania

How do we bring innovation to the Administrative computer business? Competition demands that we seek new technological initiatives that make a difference. New systems should not be developed as a matter of rote but as a matter of strategic importance. But, how do we do this? By recognizing that the most important things are not always most apparent. Someone must take leadership and explain that traditional remedies are not always creative remedies; that computer specialists can become absorbed in minutia and forget the dream. Let's get things on track and remember that we harness the most important tool of the century for organizational efficiency and effectiveness. This paper is a report on innovation in Penn State administrative computing.

## IS THIS CREATIVE, OR WHAT!

What an exhilaration! Here, at my desk, I can inquire into databases that are in my personal computer or in computers that are thousands of miles away. I can inquire about census data, health data, student data, financial data . . . all within easy reach . . . right from my desk. I can visit libraries with millions of volumes, search for articles, connect with others who have published before me. I can work at home or in the office in a continuum that knows no geographic or time boundary. I can collaborate, electronically, with writers and thinkers and managers like myself across the nation . . . at my desk. What are the limits? Where are the boundaries? Only in my mind.

Is this creative, or what! It is the very essence of creativity. In all of my career experiences, none match the creativity that I experience at Pennsylvania State University. The University is alive with creative ideas and bold conceptions of the application of technology. Examples of this creativity are numerous and I will try to touch on a few along the way. But, it is not my purpose to demonstrate Penn State's creativity as much as it is to discover the reasons for it. Just what is creativity and how is it activated?

I submit that the first requirement to activate creativity is to recognize when creativity is at work. The relentless pace of change, these days, obscures the investment that is made in one change as compared to another. Creative changes are absorbed as just another pedestrian, day-to-day occurrence. Is it spectacular that thousands of individuals can access a single database simultaneously? No, not particularly. Is it amazing that we can transmit electronic mail nationwide? No. Once, it was amazing, but no more. And why is this? Because it is the nature of creativity that it is creative only once. Then, it becomes prudent. Telephones, for example, are not thought to be creative, but they are certainly prudent. Most businesses could not get along without them. This, then, is a clue to the nature of creativity. It is a transitory event. We, who are in the business of high technology, must recognize that one creative event is not long lasting. It is no longer satisfactory to achieve a single creation. As the agents of change in our institutions, we must seek an environment that produces a continuous stream of innovative changes. To quote Warren McFarlan of the Harvard Business School, the information systems function is "in the business of bringing a sustained stream of innovation in information services to change the company's internal operations. . . and external products."[1]

### ART OR SCIENCE

As long as I can remember, it has been debated whether computer programming is an art or a science. Is the creation of a computer program analogous to the creation of a watercolor painting or cataloging the stars of the universe? The question is important because it leads to conclusions about the management of computer programming, systems development and technological change, in general. Ignored in the debate is the much more fundamental question of creativity. In our quest to

[1] F. Warren McFarlan and James L. McKenney, *Corporate Information Systems Management: The Issues Facing Senior Executives*, Richard D. Irwin, Homewood, IL 1983

categorize technological change we have failed to understand its underlying creative nature. Because we conclude that technological change is more science-like than art, we tend to focus on "method" rather than "result." We "administer data", "initiate projects", "define requirements", "prepare reports", "develop programs" in a structured way. Hardly ever do we brainstorm or monitor the sources of innovation. Why? Because that is the way we've been taught.

Believe it or not, the popular conception is that technologists are creators. We are thought to hold creative solutions to social progress, efficiency and institutional success. Given that this is true, lets get on with it. Let us understand the factors of creativity and how they are applied.

## WHAT IS CREATIVITY

To define creativity, I will begin with a quote from Herbert Simon:

> *"About forty years ago, the Federal Courts put themselves in the position of requiring that for an invention to be patentable there must be proof that a "spark of genius" had occurred. The language was Mr. Justice Hand's. The trouble with sparks of genius, and similar evidences of creativity, is that they are not photographable, hence are difficult to introduce as evidence. As long as we refer to acts of creativity with awe and emphasize their unfathomability, we are unlikely to achieve an understanding of their processes. Fortunately, it is not necessary to surround creativity with mystery and obfuscation...The simplest way to find a definition of creativity is to observe when people apply the term "creative" to some human act. Acts are judged to be creative when they produce something that is novel and that is thought to be interesting or to have social value . . . But in the last analysis, each field must make its own judgements of creativity; each must decide what is novel and what products are interesting or valuable."*[2]

Notice that this description does not deny that "spark of genius" is a characteristic of creativity but it is not the only characteristic. Another clue to creativity is that it is more often the result of hard work, dedication, chance or timing than "spark of genius." Thomas Edison tried literally thousands of materials before he came across a suitable light bulb filament. He attributed invention to "99% perspiration and 1% inspiration."[3]

Creativity then is an ACT that produces SOMETHING which is NOVEL and has VALUE. The outward sign of creativity is CHANGE. Not any change but novel and valuable change. Change for the sake of change is not creative. Change that makes a difference is creative because it is novel and has value.

[2] Conference Proceedings *Frontiers in Creative and Innovative Management* edited by Robert Lawrence Kuhn, Ballinger Publishing Company, Cambridge, Massachusetts, 1985

[3] Robert Friedel and Paul Israel, *Edison's Electric Light*, Rutgers University Press, New Brunswick, New Jersey, 1986

## CREATIVE MANAGEMENT

Peter Drucker is the best source I have found for instruction in creative management. His book, *Innovation and Entrepreneurship*,[4] explains clearly how to be innovative. Being innovative (i.e.: creative) requires that you view your job differently. It requires personal transformation from developer to creator. Let me explain with an example. **Figure 1** is Drucker's innovation model and ***Figure 2*** is the traditional systems development model. **Note the difference.** The traditional model begins with PROBLEM DEFINITION as compared to the innovation model's SOURCES OF INNOVATION. PROBLEM DEFINITION is a narrower objective than searching, first, for the sources of innovation. Do problems always precede innovation? Certainly not. As offices of technological change, we are on the cutting edge of our institutions and should recognize what we are cutting . . . red tape, partially; inefficiency, partially . . . but more than that, we are cutting new trails. If we start with a narrow, problem solving conception we will shackle to lowered expectations. For the sake of our institutions, we must seek broader opportunities rather than problems; creations rather than solutions.

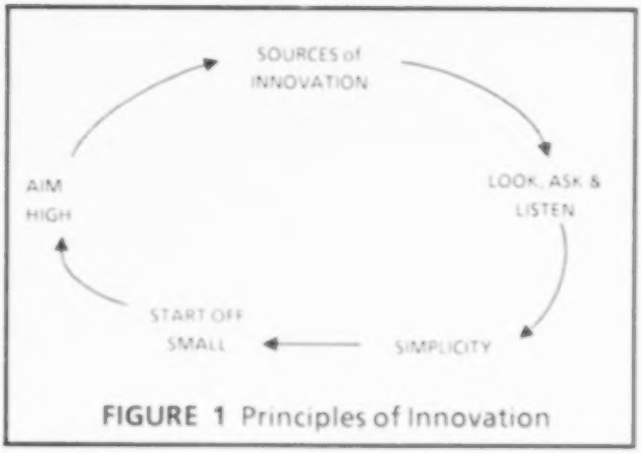



**FIGURE 1** Principles of Innovation

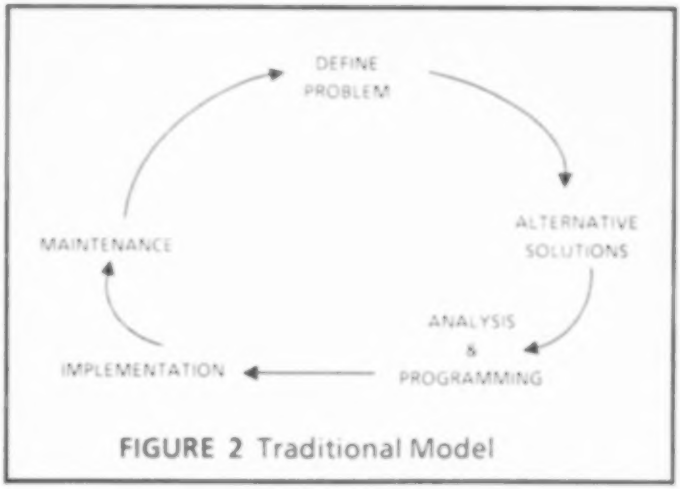



**FIGURE 2** Traditional Model

[4] Peter F. Drucker, *Innovation and Entrepreneurship*, William Heinemann Ltd, London, England, 1985

## THE INNOVATION MODEL

Using Drucker's model (Figure 1), I will briefly review some innovative activities underway at Penn State. Keep in mind that innovative changes are those that are novel and have value. For the sake of understanding at Penn State, novel means new to Penn State. It does not mean universally novel. Voice response registration, for example, is novel at Penn State even though it has already been implemented at other institutions.

### Sources of Innovation

The first step of Drucker's model is to look for the sources of innovation. Before rushing into something with low value, take the time to survey the opportunities to innovate. As Drucker explains, *"it is change that always provides the opportunity for the new and different. Systematic innovation therefore consists in the purposeful and organized search for changes, and for the systematic analysis of the opportunities such change might offer for economic and social innovation."* The changes that must be systematically monitored are those shown in ***Figure 3.***

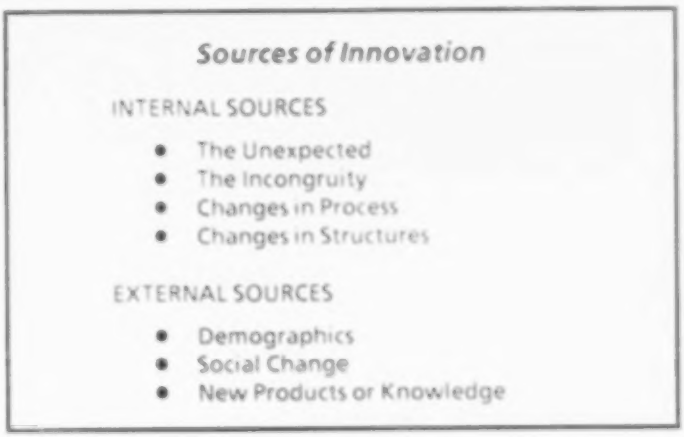



**FIGURE 3** Sources of Innovation

They are the sources of innovation. Although these sources are all relevant, I will focus on is "changes in process."Changes in process are changes in the way we conduct business, structural changes. To systematically search for creative structural changes, it is necessary to foster high-level debate and evaluation of the technology agenda. High-level officers, I have found, are the primary source of creative thinking. At Penn State, the high-level debate commences with strategic planning. Once a year, as the head of administrative computing, I prepare an administrative computing plan for the following year. This year I also prepared a five year forecast of areas of greatest payoff during the next five years. Penn State's strategic plan is not an idle document. It is reviewed by many before it is approved and even then it is only partially approved. The strategic plan sets the floor for development activities but does not tell the whole story. Beyond the global initiatives of the strategic plan, there is continuing discourse on the priorities assigned to day-to-day work. This discourse is very creative and generally surfaces projects of greatest

urgency and opportunity. The participants are highly placed individuals who have an excellent understanding of Penn State as it compares to other Universities. They naturally bring creative, competitive topics to the administrative computing work schedule. The key to unlocking creativity is the cultivation of an environment that encourages creativity to flow.

Another source of innovation that we are monitoring at Penn State is computer aided systems engineering or CASE. This area is especially ripe with creative opportunities. We are moving into CASE slowly because we want to realize it's full potential at each stage in the development cycle before moving to the next. A hasty implementation could result in uneven acceptance and halfhearted participation. We are evolving to our own CASE tool kit in an innovative way. CASE is not a prescription, it is an adaptation. People are beginning to use CASE because they have personal "ownership" of the idea. CASE is happening because the staff is creative enough to want it to. The staff, on its own recognizance, is seeking out novel solutions to our systems development backlog. Once again, it seems we have an environment that is encouraging creativity to flow.

Yet another fruitful source of innovation at Penn State is end user computing. Several years ago we began the "user initiative" which put policies, procedures, tools and security mechanisms in place to encourage end user computing. Today, we are seeing the early payoff of that initiative. Users are coming up with their own creative computerized solutions to doing their jobs better. Their activities are naturally being enhanced by the computer industry and its unending stream of end user computing tools. Again, there is an institutional willingness to cultivate this rich creative end user environment.

## Look, Ask and Listen

We are not alone when it comes to innovation. To find sources of innovation, we must keep our eyes, ears and minds open. CAUSE, as one example, is a tremendous source of creative ideas. Our sister institutions are another. To be creative, we must look, ask and listen to the needs being expressed by others. It continually amazes me how simple it is to satisfy some of the most essential needs, if they are understood. It also amazes me how poorly most innovative opportunities are communicated. Before we can create, we must convince others that it is important. We must look, ask and listen to develop advocates for innovative ideas. By listening well, we learn how to shape an idea and make it "right" for the situation at hand. The CASE solution at Penn State is "right" because diverse needs and opinions have embraced its benefits.

As technologists, we must be better than anyone at finding the most creative opportunities. Challenge yourself, sometime, to enumerate creative things that you could do for your institution. I do this routinely. As a personal challenge and test of my understanding of Penn State, I routinely prepare a list of the "five most important" things to be done. The list changes with time. Some things lose their importance. Others assume a greater prominence. To prepare the list properly, I must inquire into the needs of other offices. I must spend time with individuals and managers of those other offices to look, ask and listen to their greatest needs. I must encourage them to brainstorm with me a little. Surprisingly, I find that the five most important things are not always intuitively obvious. They spring forth through creative exchange of ideas. They are typically cross-discipline changes that result from a global view.

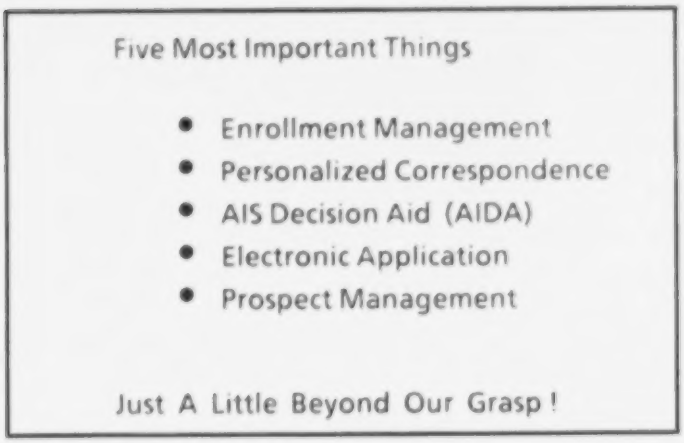



***FIGURE 4*** Five Most Important Things, Fall 1986

***Figure 4*** is the list of what I thought were the five most important changes to be made in Fall 1986, one year ago. I am showing them to prove a point. Once I understood that these were important, it was necessary for me to convince others as well. I do not arbitrarily impose my priorities onto our development schedule . . . I try to influence others to change the schedule. The five most important things then become my agenda for lobbying. An innovative idea, no matter how good, should not be implemented if it is not accepted by others. The point that I wish to make is that the five most important changes from a year ago, have been endorsed, and are not in various stages of implementation. The five most important of this year are still under discussion.

## Simple and Small

Peter Drucker observes that the most creative ideas are often the most simple. Penn State has a development strategy built around this principal. It is known as incrementalism or "chunking." It is not a major change, intellectually, but it is a major change from the past. Incrementalism is an approach to big system development which intentionally divides them into smaller chunks. Instead of considering all of the things necessary to build a personnel system, for example, we choose to think about those things that will give us the greatest payoff in the next few months. Amazing as it may seem to some, major achievements are possible in a short period of time.

Many benefits derive from the incrementalist strategy. First, it causes us to better consider what changes are worth. If you focus on short term objectives, it is easier to say what is most important. The incrementalist strategy asks "what can we do for you now"; not, "what do you need forever?" My observation, is that with the traditional PROBLEM DEFINITION approach, we tended to focus on global objectives rater than short term accomplishments. We tended to seek ultimate solutions. Expectations were raised and gratification delayed. A dangerous mixture that could, and frequently did, result in conflict. We didn't talk about important things that could be done now nor assign value to chunks that could be realized soon. Instead, we focused on master plans which would likely change during the development life cycle.

You might say the incrementalist strategy is creative because it naturally leads to valuable technological change. The most valuable changes find their way to the top of the list easily. At Penn State, for example, we had to find a new way of managing student progression to their major fields of study. Many majors are limited by the limited faculty and facilities that are available to support the major. The technological solution to this problem came to be known as AMPS -- Advancement to Majors Preference and Selection System. It is a creative solution that gathers the preferences of freshmen and sophomores and then ranks the students that want to enter a common major. The AMPS system has proven invaluable for managing a complex and sensitive problem.

### Aim High

The last piece of advice that Drucker offers for managing innovation is to "aim at leadership." This is the key to innovation. Throughout the previous sections, I have explained how we search the sources of innovation; look, ask and listen; and divide our activities into small and simple chunks. But, this is not enough. In addition, we must aim at leadership. We must seek out small, simple solutions that are at the edge of our technology. There are many examples of this at Penn State.

Somehow, we want the very best systems with the most advanced features that are available today. We seek out solutions that are just beyond our grasp and it causes us to strive for excellence. Currently, we are working hard to expand end-user computing within a security framework that controls data access by function and value. The twin values of easy access and tight security controls are diametrically opposed...but we try anyway. We press the limits of fourth generation languages to achieve systems that are easy to build and, at the same time, efficient. We employ fiber optic links for improved terminal response times. We have begun using baluns for transmitting coaxial cable signals across ordinary telephone lines. We are implementing an electronic approval system for handling on-line forms. We have implemented FOCUS to integrate microcomputers into our telecommunication network for file sharing and local data analysis. We are implementing a new Student Longitudinal Research Flat File (SLRFF) for longitudinal analyses of student data. We are implementing a voice response registration system which can communicate directly with students by phone. Each of these innovative activities were initially thought to be beyond our limits but each is now well along the way to reality. Nothing is impossible as long as we strive for it. At Penn State, we aim high!

## CONCLUSION

In this paper, I have tried to make the case for implementing technology in a new way, in a way that emphasizes creativity. I believe the basic reason is that our institutions expect us to. There are five simple principles which capture the fundamentals of innovative management:

1. Create or Perish If we don't, someone else will.

2. Five Most Important -- Challenge yourself to enumerate them. The first step of innovative management is to be able to recognize innovative opportunities.

3. Least Size with Greatest Value -- Bigness is not a measure of value.

4. Results Now -- First things first.

5. Beyond our Reach -- Strive for leadership.

The challenge embodied in these principles is tantalizing . . . a challenge summed up in the act of seeking small accomplishments, small accomplishments which can be achieved in a short period of time and, yet, represent bold new strokes in our technological infrastructure. This, then, is creative, or what!

# JOINT APPLICATION DESIGN:

## Can a User Committee Design a System in four Days?

Diane Kent,
University of British Columbia,

David Smithers,
Computech Consulting Canada Ltd.,

Vancouver, B.C., Canada

**JAD** (Joint Application Design) is a two to four day structured workshop in which users (including faculty and management) and the project analyst produce a fully documented application solution with enough detail to allow technical design and programming to begin almost immediately. Sound impossible?

At the University of British Columbia we used a JAD for the first phase of our student record system development. The project in itself was an ambitious one - moving from a batch system with arena registration to a distributed system with touch-tone telephone early registration. Thus, using a technique which put a dozen users together in a room for four days to define and document requirements and to complete the functional design seemed like suicide to some.

Using our experience, we will describe how the JAD process works, what results you can expect, how to adapt JAD to an educational environment, and how to ensure that the JAD produces a successful functional design.

## INTRODUCTION

Joint Application Design (JAD), originally pioneered by IBM about seven years ago, is rapidly spreading in use by North American organizations, both public and private. In addition to IBM, who have used JAD's on hundreds of their own projects, other well-known users of the technique in the United States include Texas Instruments and the Continental Bank. In fact, executives from these corporations recently shared their experiences with JAD in a James Martin/Deltak video series. In Canada, the technique was recently used by IBM to plan for and design all of the support systems for the 1988 Winter Olympics in Calgary.

At the University of British Columbia we initially used JAD during the first project of many to re-design our student information system. The project itself is an ambitious one - moving from a fifteen-year old batch system with punched cards and arena registration to a distributed system using touch-tone telephone early registration. Thus, using a process which put a dozen users together in a room for four days to define and document requirements and to complete the functional design seemed like suicide to some.

We survived the experience, as you will see, and hope to convince you that if you control the scope, manage user expectations, give the information professionals the right tools, choose the right participants and adapt the technique to a higher education environment, a user committee can indeed design a quality system in four days, using Joint Application Design.

## WHAT IS JAD ?

JAD is a technique that allows you to lever one of your scarcest resources - experienced people. It is a structured and intensive workshop involving primarily key users and management, both faculty and staff, who are knowledgeable in the area of the business to be automated, and one senior analyst or project leader. The workshop is sponsored by a committed executive, who understands the JAD process. It is conducted by a leader with special skills, who facilitates and manages the group dynamics of the session. In addition, although they do not directly participate in the workshop, key supporting players such as scribes, automated design tool specialists and a logistics co-ordinator are also invloved. (The individual roles of the major participants will be discussed below.) JAD is intended to analyze user requirements and complete the functional design of a system, replacing the traditional steps of requirements definition and systems design.

In our JAD, we held one four-day workshop which covered the requirements and design of:

- registration (including the dialogue for the voice-response system),
- course scheduling and room bookings, and
- supporting portions of the course catalogue and the facilities management systems

In retrospect, this scope was far too broad. We should have held three workshops, with varying participants, for each of the sub-systems. Also, we should have considered holding separate requirements and design workshops to handle such a broad scope. It is a tribute to both the session leader and the participants in our JAD that the requirements and the design actually did get done in four days!

## HOW THE JAD PROCESS WORKS

The basic process can be viewed as a simple system, requiring certain inputs which must be prepared in advance of the workshop, the workshop (or system) itself, and the outputs of the session which are reviewed and fine-tuned as part of the wrap-up, before becoming inputs to technical design and installation. We will focus first on the input side.

**Objectives and scope** typically come from previous planning work. They are communicated to the team by the executive sponsor at the start of the session, together with any assumptions and constraints.

**A Familiarization Guide** replaces the traditional requirements step of reviewing present systems and interviewing users. This guide is an informal list of forty questions which ask user participants about planning, receiving, tracking, assigning, processing, recording, sending and evaluating the work they do. In our JAD, these were prepared by holding several small group meetings with key faculty and Registrar's Office staff, with each group completing guides for each of the three systems under consideration.

**Pictures of the current process,** an item not normally associated with requirements definition, is a valuable input to a JAD. These help participants focus on the reasons why the system is being developed or replaced, and give those who do not have day-to-day exposure to some aspects of the current process a better conceptual idea of the problems. During the preparation for our JAD, the University held its 1986/87 winter session registration, so various JAD participants were sent out trailing friends or relatives through the torturous mass registration process, which takes the average student about five hours to complete, waiting in long lines most of the time.

**Prototypes** of the new systems may be prepared prior to the JAD. This is typically the case if you do a requirements workshop followed by a design workshop. In our JAD, although we did requirements and design in one workshop, the previous planning process provided sufficient detail of the requirements to allow the support team to build a prototype in parallel with other preparation tasks. This prototype proved invaluable during the session and was part of the reason why such a broad scope was successfully covered in one JAD.

**"What others do"** encourages participants not to re-invent the wheel. We were able to draw on the experience of the ever-increasing number of universities and colleges who have implemented telephone-based early registration. In particular, when the dialogue between the student and the system was designed, the team reviewed the dialogues of the University of Alberta and Brigham Young University, using these as a starting point for our system.

What results or outputs can you expect from a JAD session?

**User or functional design specifications,** including the benefits of developing the new system, are the main output. These ought to include: process models, data models and a data element dictionary; report, screen and form layouts; and a prototype, either automated (preferred) or on paper. Our JAD, for example, produced over 200 data elements, 45 screen layouts and 17 reports.

**Issues** are another important output from a JAD session. If you have the right participants, a large number of issues will be resolved in the session itself. However, the remaining issues will have to be assigned to someone for resolution by a specific date. In a higher education environment, a larger number of issues usually remain unresolved after the session, due to the decentralization of the decision-making process. We had 35 such issues identified in our JAD session.

**A structured review session** , sometimes called Joint Application Review (JAR) is the last step of the JAD. In our case, the JAR was held one month after the JAD, lasted one day and involved all of the original participants. Its purpose is to review the functional design and prototypes, and to resolve as many as possible of the issues left unresolved at the end of the JAD.

The inputs, the outputs and the JAD session itself can be effectively *levered* through the use of automated design, documentation and prototyping tools. Such tools replace voluminous paper specifications and prototypes, making revision and updating easier; allow reaction to live screens; and increase the rigour of the design by using cross-checking facilities. In addition, structured thinking by all participants can be increased by using Computer Assisted Software Engineering (CASE) tools, which demand that data elements and processes be entered in a structured top-down or bottom-up fashion.

## BENEFITS OF USING JAD

As mentioned earlier, the JAD technique is rapidly spreading in use in North America, primarily due to its benefits. The benefit most often mentioned is that the technique can reduce the elapsed time for user requirements and design by up to 40%, by consolidating these activities into several days. What JAD may not do, especially the first few times you use it, is reduce the overall effort (person-days) for these activities. Other key benefits include:

- An increase in productivity of the design team, resulting from the use of dedicated resources over a short period of time, in contrast to other techniques which use fewer, part-time resources over a long period of time.

- Improved design quality and value to the organization, since most people who take part in the session are from the departments who will use the system. High-quality solutions, designs which are functionally complete and the resolution of conflicts in the operational requirements of different users will also follow from a JAD. This, in turn, will help reduce maintenance costs.

- Committment, enthusiasm and consensus between users and information systems professionals, resulting from a user-driven design which not only meets users' needs, but is also politically acceptable.

- Removal of the analyst or project leader from the impossible role of resolving conflicts on user issues, since these are identified and resolved by the users themselves in the JAD session.

- A highly structured environment in which users can develop "computer literacy" and systems professionals can develop a "business understanding" in a relatively short period of time.

## OTHER USES OF JAD

Although originally developed for design, JAD has now also been successfully used in other stages of the systems development life-cycle. Application or project planning is actually part of the original IBM technique and is called JAD-Plan or Joint Requirements Planning (JRP). A JAD-Plan workshop is intended to precede one or more design workshops and results in high-level documentation for the entire application or project, including definition of scope, business objectives, overall systems requirements and a schedule and plan for the JAD design sessions themselves.

At UBC, we have successfully used a modified JAD planning technique to hold a series of workshops with managers in the Food Services department to develop an information systems plan for campus food services. Early in 1988, we plan to use JAD for our Human Resources system

planning. In addition, since we are reasonably sure that a large part of the system will be a package, we will have our first opportunity to use the JAD design technique for package selection and configuration.

Other organizations have used JAD techniques for Information Resource Planning, Strategic Planning, identifying office automation requirements, and systems maintenance.

While the JAD technique in itself can be used effectively in almost all stages of systems development, greater benefit, or leverage, if you like, can be gained via integration with other tools and techniques. We have already discussed the benefits of automated documentation and prototypes. If these can be linked directly to application generators, then the acceleration of the design stage can be duplicated in the programming stage. Further, once the system is in production, maintenance by regeneration through these tools will help protect the benefits gained in the earlier stages of development. In fact, if you can use JAD and an integrated set of tools right from the initial stages of strategic planning through to maintenance, then you will be in the forefront of technology and will be able to develop quality systems in a shorter elapsed time.

It is only through this integration and acceleration of all phases of systems development that you can maintain the design quality and the user committment and enthusiasm built by the JAD design sessions. This has been a particular problem at UBC. We have a 4GL and other good development tools, but they are not linked to the automated design tools we used in the JAD, nor do we have an application generator for program development. Hence, we reverted to "classical" techniques for technical design, programming, and testing, which left a long elapsed time between the JAD and implementation. Fortunately, the academic policies and procedures which must be changed to accomodate an early registration system also took a long time to develop and approve, so the longer development time has not been entirely focused on the information systems group.

## SELLING THE JAD TECHNIQUE

Selling the JAD technique usually requires a "champion" from any one of the participant groups (typically Information Systems) to lobby with management and executives for the use of the technique. The benefits of JAD, particularly the reduced elapsed time for design and the improved quality of resulting systems, are effective in selling this approach to senior management. Our champion was a newly-hired project leader who came to us via the local telephone company where the technique is used extensively.

Once the executives and sponsoring management are "sold", JAD participants are identified and their availability for the session is arranged. The normal approach is to go through the organizational heirarchy, making arrangements with the department heads, deans or vice-president. While this works well with staff participants, the approach fails when used to arrange for faculty members' participation. We found that it is much better to approach the faculty members directly and let them decide the conditions of their participation and inform (or not inform) their department heads and deans.

One of the biggest obstacles standing in the way of selling JAD is people-resistance. This resistance will come from all groups, but will be strongest in the Information Systems group. Visible executive and senior management support, together with participant training, will normally help overcome this resistance; however, this does not seem to work well with faculty members. Therefore, it is important that the executive sponsor be a senior academic administrator with considerable credibility both as an academic and as an administrator. We were fortunate that our sponsor, the Associate Vice-President for Academic Services, had been Dean of the Faculty of Science and has 35 years of experience at the University. When he talked, participants listened!

Lest you believe that a strong executive sponsor is all you need, a few words of caution about selling JAD are in order. Expectations about what will result from the JAD must be carefully and constantly managed. For example, if implementation of the system is dependent on funding which will not be confirmed until after the JAD (as might often be the case in public higher education institutions), then participants should be clearly informed of this by the executive sponsor at the start of the JAD. Participants should be warned not to feel that their effort will be a failure if funding is not approved, since their continued committment and enthusiasm is often enough to obtain funding even if it is not immediately available.

A second expectation which must be managed is the scope of the system to be delivered in the first phase. JAD participants are encouraged to be creative and even wishful in their thinking; however, they must realize that some of their good ideas will not be implemented until later phases, due to budget, schedule or even technical constraints. If this expectation is not well managed, it can result in ill-will between participants and the project manager who is usually under budget and schedule pressures. All concerned must understand the project management triangle.

You now know what a JAD is, what it can do for you, and how you can sell the idea in your institution. Next, you need to know how to get it organized.

## ADAPTING JAD TO AN EDUCATIONAL ENVIRONMENT

In a university you can plan the most logical, best orgainized system, with a great cost-benefit, implement it using the latest technology and methodology and still find that the system is a failure. JAD, we believe, can help you avoid this fate, if you learn to adapt it to the educational environment. There are three areas in which this adaptation is important.

### Getting the JAD Organized

A typical 3- or four-day JAD session will take at least six weeks of preparation time. In a university, this could take even longer. How quickly can you select the project to use JAD on? How many committees have to approve this? Once you have the project approved, how quickly can you line up a meeting with the vice-president who is going to be the executive sponsor? ("Oh, I'm sorry, I'm going to be away for the next two weeks doing research at the end of the Nile" is an answer you are likely to get.) Then, having identified the project and the sponsor, how quickly can you get a room with the right audio-visual and computer communications facilities? ("What do you mean all these rooms are booked for the whole term and I can only use them during Christmas vacation? It takes how many months to install a computer line?") This is all before you have even begun the six-week process of completing the familiarization guide. The message here is: don't start unless you are well prepared and have the right tools in place.

### The JAD Team

Next, there is the question of the participants. The JAD guidelines tell you that the team should be composed of the business experts who either have the authority, or have been delegated the authority, to make decisions regarding both the system and the business objectives right in the JAD session. To select such a team, you must understand the culture of your organization. Naturally, you will have a committee to help you select the JAD team. You will describe the JAD process at length and end by telling them that you only want six people. You will then roll your eyes in horror and disbelief when they suggest twenty, and reluctantly let yourself be persuaded to accept nine or ten. One key to success is keeping your JAD team small.

In many univeristies and colleges, who you exclude is even more important than who you include. Do certain faculties believe that they have veto power over anything you do in a certain system? Is one dean much more vocal than the others? Should every faculty be represented? If they are not, what is the risk? If they are, can they reach ever reach consensus? These are questions which you must be prepared to ask and to answer.

Even more important in higher education is the participation of faculty members themselves in the JAD. You will certainly get asked by one dean if faculty have time for such frivolity. The answer, of course, is yes, but how do you reconcile this with a faculty member's teaching responsiblities and still get the full-time committment you need? At UBC, we developed a *buddy system* , which paired faculty members, so that one could attend the JAD while the other was teaching.

Being aware of these potential problems and being creative in solving them will help you ensure that the system gains political acceptance as well as technical acceptance.

The other member of the JAD team who must be selected carefully is the JAD session leader. You will need a person who is a good communicator and negotiator, but most importantly a good listener. He or she must also be able to control a group, encourage creativity and, where necessary, use the power of persuasion effectively. Some experience as an educator will also be valuable. In addition, this person requires technical skills in the areas of data modelling, data flow techniques and system design.

Particularly important in a distributed system, such as a registration system, is a leader who is seen as neutral. A great deal of compromise is needed to design a successful system in such a short time, and thus the leader cannot appear to favour a particular user department or the information systems group.

So where do you find such a renaissance man (or woman)?

Many of the organizations who use JAD extensively have full-time staff who are well trained as JAD leaders. Most colleges and universities will not have such a person; and, if they did, somebody with such a high profile in the orgainzation would be in such demand that he would be out of the job in three months. What UBC and others have done is to find outside experts or consultants and use them to run the first few JAD's, while training one of the local staff members in the process. As an additional benefit you may find that consultants can offer advice on structuring the JAD session, system design standards and concepts and approaches which have worked well in similar systems. As the technique is used more widely, you may find that you can *trade* session leaders with other institutions, especially to establish the leader's neutrality.

Having finally organized the JAD and assembled the team, you will have to turn your attention to the JAD session itself.

**The Jad Session**

One of the most difficult tasks in the session is controlling the scope. Three days go by so quickly that if your leader is not able to keep the team within the scope you will find that the job is only half finished. Many of the participants will be so excited about being asked, for the first time, to design their own system that they will attempt to explore and resolve every possible problem. Also, the leader must not allow exceptions and rare problems to shift the focus from the main issues.

One of the ways to keep within scope, and at the same time keep the energy level of the session high, is to structure the day for variety. Concentrate on one area of the system for several hours, taking it only to a partial conclusion, then switch to a new area, returning later to finish the first area and handle the exceptions. However, if this approach is to work well, you will need a good set of minutes.

Taking minutes for a JAD session is an art, not a task assigned as punishment. You will refer to these minutes repeatedly during the session and find that they are a source of information and decisions in all subsequent phases of the project. The rigour with which these minutes have been recorded will be vital to the success of the design effort. In fact, in a JAD you will need at least two scribes - a user scribe, who documents issues, policies, decisions, and procedures; and a technical scribe who handles the data model, data flows, prototypes etc. Of course, the more you can automate the tasks of both of these scribes, the more successful your JAD will be.

Finally, the layout of the JAD room should be carefully considered to minimize distractions and enhance the productivity of the session. Audio-visual and computing equipment should be used to advantage, but should not be so obtrusive or extensive that it intimidates the participants or becomes a distraction. More importantly, you will want to allow some observers (especially at the first JAD) for public relations, training and for broadening the exposure of the system and the process. You must insist on a limited number of observers and a strict rule of silence, while positioning the observers' seating so that they may come and go without unduly disrupting the session.

The JAD session is now organized and ready to begin. What can you do to ensure that this committee designs a horse rather than a camel?

## ENSURING A SUCCESSFUL FUNCTIONAL DESIGN

Our experience has shown that there are four areas on which you should concentrate to ensure a successful functional design:

- the use of prototypes
- focusing on what, not how
- the systems environment
- life after JAD

We developed prototype screens before the JAD session and used these as a starting point to focus the discussion. This approach has both strengths and weaknesses. As information systems professionals we know that users generally do not know what they want until they have seen a version of it and worked with it. Prototypes can clearly fill this need. However, we must also beware of the infamous analysts' disease: "The problems I like are the ones which fit the solutions I have". In other words, prototypes developed before the final requirements are known can inadvertently focus on the strengths of the analyst and the tools, causing users to accept what they see rather than assess the requirements critically. You must, therefore, convince the analyst to design prototypes which have known flaws, so that the users will criticise the prototype, suggest improvements and begin to *own* the system.

The session leader must also warn the analyst not to suggest corrections to the prototype too quickly. The most difficult concept the analyst must learn is that the users have to take the time to design the system themselves. Many analysts are like Saint Bernards, rushing to the rescue of the

users and smothering them with solutions before ascertaining whether or not they really need help.

One of the other difficult tasks for the session leader is to keep the users focused on what they do, rather than how they currently do it. Instead of saying, "I have to put the course cards in three different piles, one for the majors, one for the engineers and one for everybody else", the session leader has to teach the user to say, "I need to be able to reserve a certain number of places in a course for various groups of students". A prototype screen, introduced at an early stage and based on the current system's three piles, may result in the users forgetting to ask the question, "Are there any courses which need to reserve places for *more* than three groups?"

In developing prototypes and holding a design workshop, it is important that the session leader and the people doing the prototyping have a good knowledge of your existing systems environment. If you have screen design standards, insist on their use. If you do not have such standards, put them in place **before** the JAD begins. This will prevent time being wasted in the session discussing whether the screen name should be five characters or six random numbers, and whether it should be in the upper left-hand corner or the right-hand corner. The design will also proceed faster if the leader has a clear vision of what the whole system should look like and how it will interact with the users.

After the design session, let the professionals who know the capabilities of your particular software polish the design and optimize it from a programming and performance perspective. Then, hold a design review, in which the systems professionals explain the changes they have proposed and ask the users for approval. It may be a humbling process for the systems people and lesson in reality for the users, but it is well worth the time and the effort.

Now, having finished the enormous task of organizing and actually running a JAD, you turn your creation over to the systems development staff for programming. For a few weeks, the users who made up the JAD team feel relieved that it is all over and become immersed in their jobs, catching up on all the work which was left on their desks. However, they eventually emerge and begin to ask, "Is there life after JAD?" The answer is, yes!

The team can still play a role during the systems development stage, and, in fact, is a resource which should not be lost. Despite the success of the JAD, design is never finished. In a large organization, like a university, you should have the JAD team conduct a *prototype tour* , so that all departments have an opportunity to provide input to the system. This tour, if properly managed, will result in a broad base of users committed to the system, rather than just the small group involved in the JAD. At the same time, the team should be using the prototype and the JAD minutes to develop user documentation, test cases and a training plan. After all, it is their system, so why would they want to let programmers write documentation for them?

As programming progresses, new requirements are identified, programmers suggest better ways of doing things and users themselves may have new ideas. Re-convening the team periodically to review changes in the design is an excellent way to continually improve the quality of your system. At the same time, the team members can be assigned to follow up issues raised at the session which could not be resolved at that time. At UBC, we established an Advisory Committee, with representatives from each faculty, to deal with policy, procedures and implementation issues on an on-going basis, using the JAD team as key members of that committee. By being involved in these two activities, the team will continue the momentum and the committment built during the JAD, and, hopefully, spread the word to others in the organization.

## CONCLUSIONS

Can a user committee design a system in four days? Yes, but in our experience you must pay careful attention to five areas. First, keep the scope of each session as narrow as is practical, even if this means holding several two-day sessions rather than one four-day session. Second, learn to manage user expectations, before, during and after the JAD. Third, give the information systems professionals the tools they need to make a JAD effective. Technology is now available to handle documentation, data modelling, data flow diagraming and prototyping, all of which will significantly reduce systems development time. If you do not have these tools or cannot get them, then you may not want to use the JAD technique. Fourth, choose the JAD team and leader carefully. The wrong users, even with a good leader, will not develop a quality system. Finally, don't be afraid to take the technique and adapt it to an educational environment.

## PAPER PRESENTATION ABSTRACT

**Title of Paper Presentation:**
*Making It Happen Without Appropriation*

**Author:**
Robert E. Roberson
System Vice President for Computer Affairs
University of South Carolina

**Summary of Paper Presentation:**

Higher Education is being challenged by budget crises involving substantial reductions while at the same time technological services are being asked to increase support in all areas: increased access, improved response, more capacity, expanded consulting, a wider range of software, micro's and terminals, courses on technology and on-going upgrades in all areas. One can either wait for appropriation and/or allocations to increase resources or initiate a course of action which provides for growth and expansion by developing sources of revenue and by use of management practices which meet institutional objectives but eliminate those services where limited support and usage deny justified expenditure.

**Outline of Paper Presentation:**

I. Background -
   - A. Funding Status
   - B. Student to Access Ratios
   - C. Growth Data - Volumes/Applications
   - D. Impact on Communications
   - E. Microprocessor Influence
   - F. Literacy Issues

II. The Cost Center Approach -
   - A. All Operative Areas are Cost Centers except one overhead entity - Vice President's Office/Business Operations.
   - B. Cost Centers may be all or part revenue or appropriated funds.
   - C. Centers grow by increased appropriation and/or revenue.
   - D. Lack of growth of funds means lack of support.
   - E. Decrease of funds, either appropriation or revenue means reduction in staff/services.

III. The Consequence of the Cost Center Approach -
   - A. Increased Staff, Services and Resources.
   - B. Expenditure Budget is Three-Plus Times the Appropriation.
   - C. Growth Opportunity is an Incentive.
   - D. Appropriation Stagnation/Reduction is Less Traumatic.

IV. Examples of Revenue Sources -

Slides will be used to portrait organization and to illustrate changes and benefits.

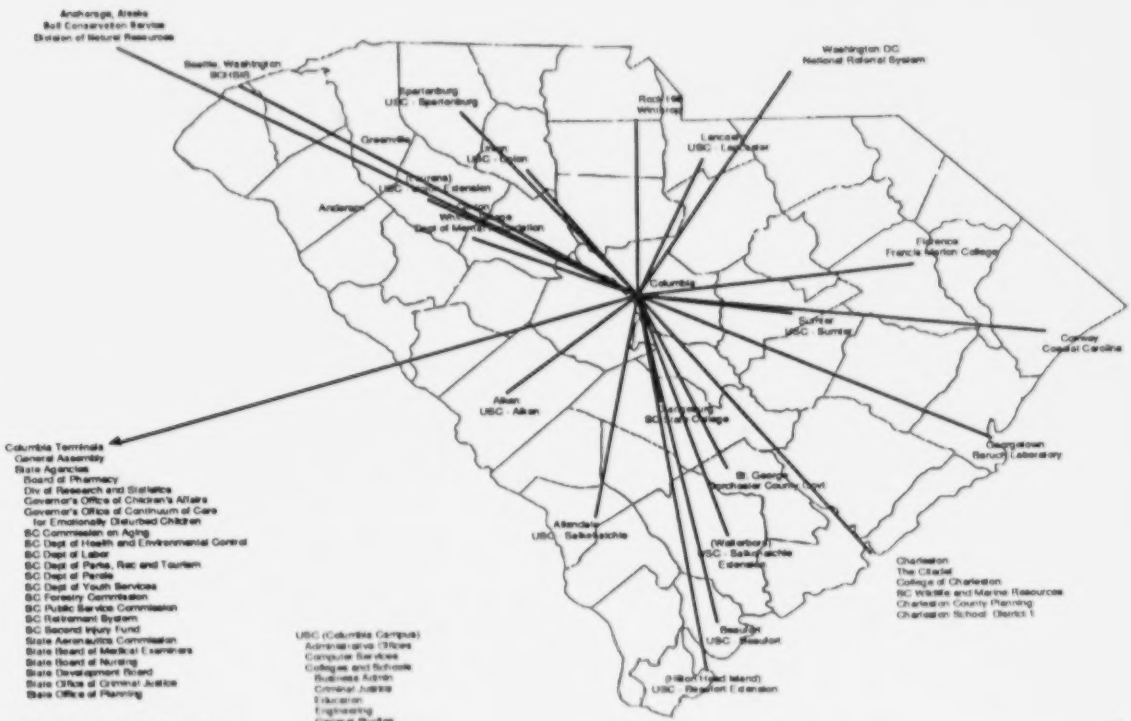
## MAKING IT HAPPEN WITHOUT APPROPRIATION

By: Robert E. Roberson

Colleges and universities whether private or public, large or small and generally without much regard for geography face increasing costs, decreasing budgets and the possibility of substantial increases in tuition. An area significantly impacted by this situation is the area of providing technological services which for purposes of this presentation include computing, communications, software availability, application development, staff, hardware maintenance and training. Hopefully, any other areas of support can be adapted to the intent of this paper.

The simplest way to illustrate the point of this paper is to make comparisons between what was and the way it is today and to communicate the methods used to achieve the change.

In 1987, as in 1981, the University of South Carolina consists of a multi-campus environment with approximately 35,000 in head count and those campuses blanket the state.



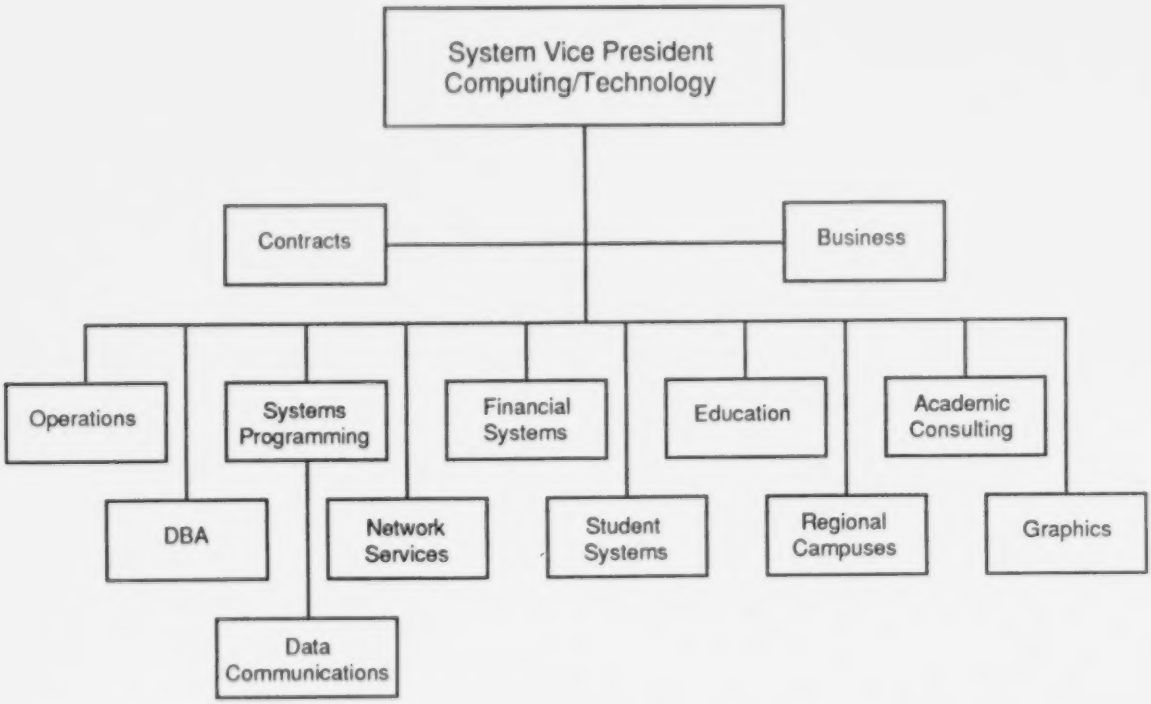

Note: Areas where technical services are provided beyond the University are annotated.

The parenthesis under some of the two year campuses such as Union with (Laurens) indicates a satellite program in areas near the campus in question.

In 1981 the only computing power in the University system was resident at the Columbia campus, with all other sites having terminals and in most cases remote job entry stations and printers available for both academic and administrative computing support. Even on the Columbia campus with almost twenty three thousand students the only computing power existed in Computer Services with a four MIP AMDAHL V6-2, accessed by RJE stations and terminals from various labs and administrative offices on the USC campus. (There was one VAX 11/780 in Engineering dedicated to a funded research project.)

There were also approximately one hundred terminals and six RJE stations in state agencies which also accessed the AMDAHL V6-2. The usage by these agencies comprised almost 50% of the usage of the in place processor and generated approximately $900,000 a year in revenue which supplemented the appropriated budget which was $4.5 million for a total of $5.4 million as an expenditure budget. The long term indebtedness of the center was approximately four million dollars.

The staff consisted of 122 full time people organized as follows:



One of the critical issues requiring attention and improvement was the ratio of students to access devices, whether terminals or micros. Even in 1983 that ratio was 415.8 to 1.

The turnaround on the main processor was indefensible and the frustration of users was apparent every day.

South Carolina is funded on the basis of a formula lump sum budget process. In the last seven years the University has not been fully funded and in 1987 the funding level is at 86% of the formula.

In fact, for FY 87-88 the appropriated technology budget under the System Vice President for Computing Technology was reduced by $482,000 from its 86-87 base, as were all other units of the University.

Against this background the demands for increased service, more capacity, new software packages, higher speed communications, never ending requests for more terminals, micros and research computing reached new heights.

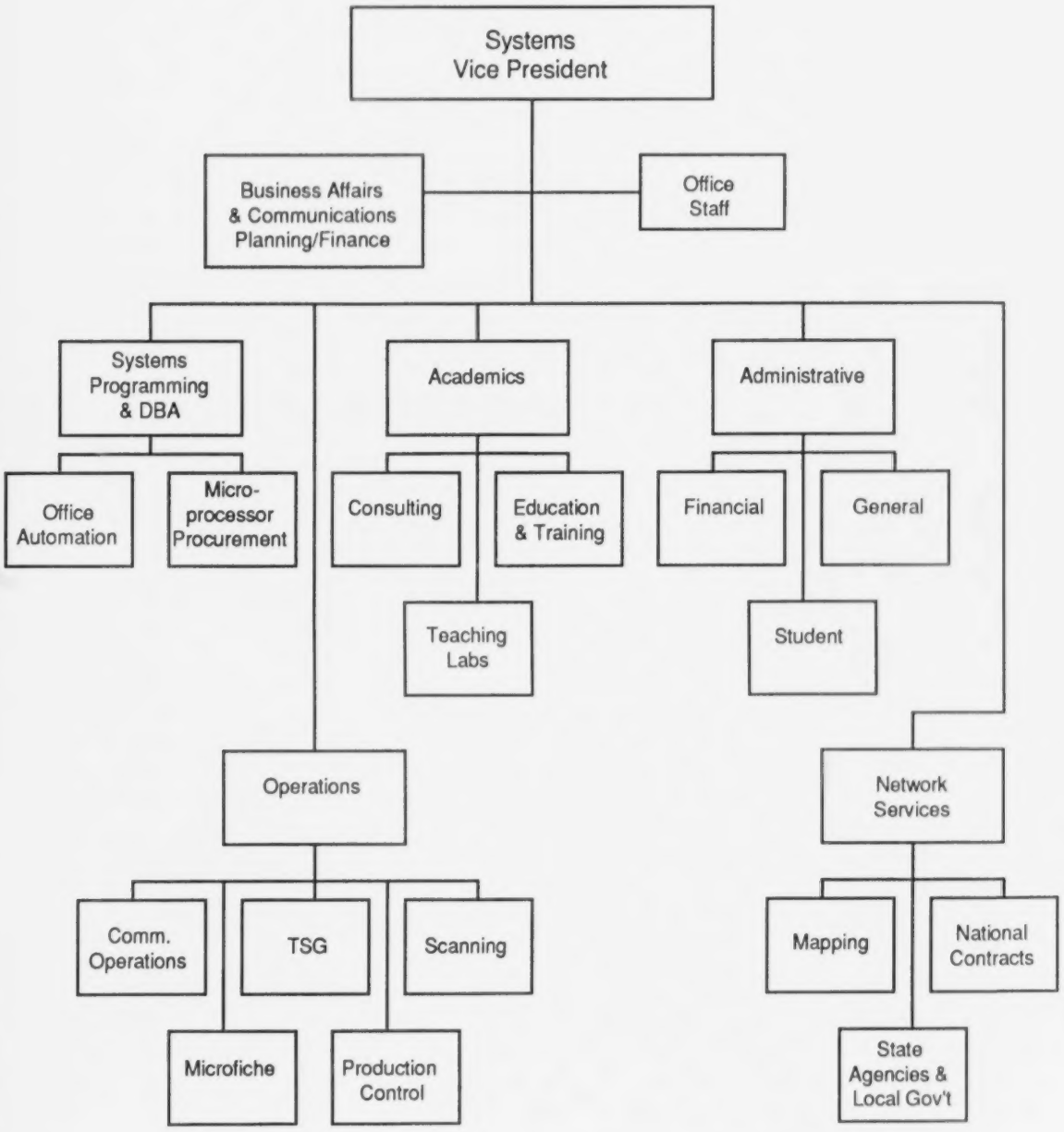
None of these actions were simultaneous, but over time the combination of such actions resulted in a dramatic change in our ability to respond to the needs of our user constituency. What did prevail was a conscious and deliberate management approach on which actions were based and on which decisions were made.

Very concisely the approach included these beliefs:

1. The demand for technology will always exceed the budgeted resources.
2. Public service is a legitimate role of an educational institution and such service can be provided economically and to the advantage of the supplier.
3. The technical component of the institution must be managed like a business, including incentives to stimulate growth and necessary reductions where "unprofitable" enterprises are clear.
4. As with all businesses there are needs for "seed" money and the opportunity to invest must be recognized.
5. The operating units within the institution's technological area must manage with flexibility and be permitted to use entrepreneural techniques where appropriate.
6. Each unit of technology is viewed as a "cost" center charged with fulfilling its mission, growing against need and supplementing its cost center appropriation with revenue.

The above guidelines for operation emerged in 1982 and have grown and evolved in practice with today's environments. Before addressing specific actions let me compare where we are today to the 1981 status previously noted.

Organizationally we now look like this:




The staff is now 190 people.

The appropriated budget is 6.5 million which includes the absorption of communications and its associated $1.3 million. Therefore, over the last six years the appropriation has actually increased from 4.5 million to 5.2 million or 15.3%. To the point of this presentation, our expenditure budget runs from fifteen million

a year and higher and our capital indebtedness has gone from four million to almost nine million with an annual cost of over $3.5 million.

Some of the key actions that provide us this environment have been:

1. In 1982 all elements of the division were costed to establish billing rates. The costs were inclusive of all expenses, eg: capital, maintenance, staff, etc.
2. All fixed contracts for external usage were eliminated in favor of billing on the basis of usage.
3. Cost center budgets for operating units were established over the entire operation with over 50% of the expenditure budget as revenue based.
4. Units unable to meet budget figures were reduced in expense (size) and frequently merged into other units.
5. Marketing of technical services was embraced with vigor to include state and local government in South Carolina and other state and federal contracts. Currently, services are in place for federal systems, four other states and over seventy five agencies internal to South Carolina.
6. A policy was established that for other than a university system microprocessor programming was not supported. It could be provided as part of service contracts for local applications.
7. Long distance billings are handled by the communications component at rates less than commercially available, but beyond cost of providing such services.
8. A microprocessor contract was implemented for resale to educational entities in the State. Over the last four years over $12 million in sales have occurred.
9. Technical training/education is offered to any state agency at a fee per course.
10. The typewriter repair service was absorbed and made a part of an existing maintenance group which bills at a lesser rate than the available maintenance contracts.
11. A student fee was implemented to generate $1.5 million a year for obtainment of instructional equipment.
12. Long term financing of equipment, predicated on a growing revenue base, allowed substantial increases in technological equipment without budget increase.
13. Over fifty-five private lines access our resources with end users being responsible for costs. A bid was issued which resulted in an overage savings of 38% per line and a benefit of 15% to the data center.
14. We are now in the process of preparing to bid cable television in the dorms. When completed with student rates offered at less cost than local cable companies it will more than pay for itself and provide 360 megahertz of data communications for broad band purposes to the University.

15. Until 1984 most terminals, controllers and printers were purchased by departments. As with other types of equipment such as 5520 shared logic systems and remote controllers, the computing technology area established ownership of the controllers and processor units with terminals, micros and work stations the responsibility of end users. In place items were funded centrally; all new devices since 1984 result in end users "buying" a share of the control devices and a share of the maintenance.
16. Maintenance on micros, terminals, controllers, typewriters and much of the communications equipment other than the PBX itself, is done by local technical staff.

The consequences of the above issues have been substantial.

- Revenue has grown from $75,000 a month to in excess of $450,000 a month.
- External usage has dropped to 26% of usage but has risen to at least 50% of the expense budget.
- One-third of the programming staff is directly supported, including fringe benefits by contract programming and software maintenance contracts.
- The ratio of students to access devices is now 18.6 to 1 (students to terminals and micros).
- In addition to two 3081 processors, a Vector processor and a VAX 11/780 centrally located, the University posesses six other VAX 11/780's in Engineering and Science and Math, an IBM 4381 in Business Administration, plus a number of smaller miniprocessors (at least twenty five).
- Within an eighteen month period, July 1986 - January 1988, two writing labs of twenty-four micros each and a ten station graphic lab will have been installed in Journalism. A fifty workstation lab is being put in place in Humanities and Social Sciences for teaching English and a graphic lab of twenty work stations for geographic needs in the Social Sciences.
- To encourage faculty to develop technological enhancement for infusion in disciplines is a need we must all address. An example of how the management theory herein proposed assisted is as follows:

This past summer three levels of interaction were offered to faculty, ie: elementary, advanced and sophisticated course development. Subsequently, grants were awarded to limited numbers and over 75 faculty participated. The courses were fee based. Since that venture four faculty have obtained private funding to develop course materials making use of technology. Our staff support these activities in various ways and revenue is derived from direct payment, royalties or a combination thereof.

The above are only a few examples of substantial gains accomplished particularly in the last forty-eight months, which incidentally does not include a ten node 8700 line locally managed AT&T PBX environment. The latter and all other upgrades have been accomplished in a period when the appropriated budget is at a level in fiscal year 1987-1988 that is lower than it was in 1984-1985.

There are management and procedural issues which become critical to the success of this approach.

Constant and detailed interaction must occur between the cost center directors. This is pertinent for particularly two reasons. It is not reasonable or beneficial to have the operative areas behave as fiefdoms. It must be viewed as an organization of components, properly managed and "self sufficient" but all components must succeed if we as a whole are to succeed. Part of the interaction involves analysis of status by cost center which involves the sharing of data such as the following reports:

1. Long Distance Status - Year to Date. (July through October, 1987)

| EXPENDITURES | MONTHLY | CUM. TOTAL |
|---|---|---|
| TSI (TOLL) | $81,324.38 | $202,430.60 |
| TSI (MEGALINKS) | $3,175.20 | $6,160.00 |
| OTHER: | $ | $ |
| | $ | $ |
| TOTAL EXPENDITURES | $84,499.58 | $208,590.60 |
| REVENUE: | | |
| ADMINISTRATIVE BILLING | $94,709.08 | $315,575.08 |
| STUDENT BILLING | $81,657.13 | $164,82.15 |
| CREDITS | $ | $ |
| DEBITS | $ | $ |
| TOTAL REVENUE | $176,366.21 | $480,447.23 |
| PROFIT/LOSS | $91,866.63 | $271,856.63 |
| TECHNICAL SERVICES (5%) | $4,593.33 | $13,592.00 |
| ADMINISTRATIVE SERVICES (5%) | $4,593.33 | $13,592.00 |
| COMMUNICATIONS (90%) | $82,679.97 | $244,672.63 |

## 2. Cost Center Status Year to Date. (Revenue)

| COST CENTER | DESCRIPTION | 86-87 REVENUE | CURRENT REVENUE | PROJECTED REVENUE Y-T-D | ACTUAL REVENUE Y-T-D | % OF QUOTA |
|---|---|---|---|---|---|---|
| C001 | VICE-PRESIDENT | $213,684 | $2,390 | $35,614 | $4,552 | 13% |
| C101 | ADMINISTRATION | $497 | $84 | $83 | $164 | 198% |
| C102 | ADMINISTRATION | $2,964 | $193 | $494 | $539 | 109% |
| C108 | ACADEMIC | $6,253 | $775 | $1,042 | $1,544 | 148% |
| C110 | ADMINISTRATION | $13,228 | $1,577 | $2,205 | $3,190 | 145% |
| C113 | AUDIOVISUAL | $453 | $0 | $76 | $0 | 0 |
| | TOTAL | $237,079 | $5,019 | $39,513 | $9,989 | 25% |
| C002 | OPERATIONS | $38,205 | $2,673 | $6,368 | $5,343 | 84% |
| C003 | OPERATIONS | $5,666 | $1,218 | $944 | $1,856 | 197% |
| C004 | MICROFICHE | $94,457 | $3,113 | $15,743 | $9,168 | 58% |
| C007 | SCANNING | $5,713 | $1,732 | $952 | $2,460 | 258% |
| C106 | TECH. SUPPORT | $135,536 | $9,601 | $22,589 | $40,963 | 181% |
| | TOTAL | $279,577 | $18,337 | $46,956 | $59,790 | 128% |
| C105 | ACADEMIC SERVICES | $48,127 | $3,416 | $8,021 | $6,812 | 85% |
| C111 | ACADEMIC-MICRO | $4,835 | $1,039 | $806 | $1,039 | 129% |
| C330 | ACADEMIC SERVICES | $530,712 | $35,793 | $88,452 | $75,825 | 87% |
| | TOTAL | $583,674 | $40,248 | $97,279 | $83,676 | 86% |
| C114 | BUSINESS | $15,126 | $935 | $2,521 | $935 | 37% |
| | TOTAL | $15,126 | $935 | $2,521 | $935 | 37% |
| C112 | ADMIN.-MICRO | $88,387 | $4,145 | $14,731 | $8,287 | 56% |
| C115 | FINANCIAL SERVICES | $0 | $0 | $0 | $0 | 0 |
| C116 | GENERAL ADMIN. | $77,148 | $0 | $12,858 | $5,835 | 45% |
| C117 | STUDENT INFO. | $7,959 | $203 | $1,327 | $571 | 43% |
| C118 | ADMIN. SERVICES | $0 | $25 | $0 | $25 | |
| | TOTAL | $173,494 | $4,373 | $28,916 | $14,718 | 51% |
| C107 | DIGITAL MAPPING | $114,137 | $26,061 | $19,022 | $54,404 | 286% |
| C300 | NETWORK SERVICES | $90,294 | $3,811 | $15,049 | $8,400 | 56% |
| C310 | NETWORK SERVICES | $212,725 | $30,284 | $35,454 | $107,684 | 304% |
| C320 | NETWORK SERVICES | $532,857 | $46,211 | $88,810 | $95,662 | 108% |
| C325 | NETWORK SERVICES | $447,050 | $21,675 | $74,508 | $52,293 | 70% |
| | TOTAL | $1,397,063 | $128,042 | $232,843 | $318,443 | 137% |
| C005 | SYSTEMS & DBA | $39,589 | $1,415 | $6,598 | $1,858 | 28% |
| C006 | SYSTEMS & DBA | $675 | $60 | $113 | $75 | 66% |
| C109 | OFFICE AUTOMATION | $41,966 | $2,676 | $6,994 | $8,453 | 121% |
| | TOTAL | $82,230 | $4,151 | $13,705 | $10,386 | 76% |
| | MISC. REVENUE ADJUSTMENTS TOTAL | | | | | |
| | OVERALL TOTALS | $2,768,243 | $201,105 | $461,373 | $497,937 | 107% |

### 3. Status of Long Term Financing.

| BEGIN | END | MONTHLY | FY1987 | BALANCE(1/87) |
|---|---|---|---|---|
| Jan-84 | Dec-90 | 32,387 | 388,650 | 1,613,911 |
| Jan-84 | Dec-88 | 2,698 | 32,376 | 64,752 |
| Aug-84 | Jul-89 | 763 | 9,156 | 23,653 |
| Jul-85 | Jun-88 | 4,396 | 52,752 | 79,128 |
| Aug-85 | Jul-90 | 38,466 | 461,592 | 1,488,552 |
| Sep-85 | Aug-89 | 85,293 | 1,023,516 | 2,447,600 |
| Oct-85 | Sep-90 | 2,838 | 34,056 | 110,359 |
| Oct-85 | Oct-88 | 25,840 | 310,080 | 568,480 |
| Nov-85 | Oct-89 | 36,858 | 442,296 | 1,102,691 |
| Nov-85 | Oct-90 | 14,268 | 171,216 | 506,135 |
| Jan-86 | Dec-90 | 2,774 | 33,288 | 118,303 |
| Feb-86 | Nov-88 | 508 | 6,096 | 11,684 |
| Jun-86 | May-89 | 9,938 | 119,256 | 264,419 |
| 65200 | TOTAL | 257,027 | 3,084,330 | 8,399,667 |
| Jan-85 | Dec-89 | 43,893 | 526,716 | 1,447,972 |

### 4. Access Ratios - Students to Devices.

| SCHOOL | TERMINAL | MICROS | TOTALS | FTE 86 | RATIO STUDENT DEV | CRT'S | FTE 83 | RATIO STUDENT DEV |
|---|---|---|---|---|---|---|---|---|
| MEDICAL SCHOOL | 13 | 10 | 23 | 278 | 12.1 | 2 | 214 | 107 |
| COLLEGE OF NURSING | 4 | 8 | 12 | 356 | 29.6 | 0 | 379 | 0 |
| COLLEGE OF PHARMACY | 10 | 32 | 42 | 215 | 5.1 | 0 | 198 | 0 |
| HEALTH | 22 | 12 | 34 | 426 | 12.5 | 0 | 417 | 0 |
| HEALTH & PHYS ED | 2 | 0 | 2 | 254 | 127 | 0 | 278 | 0 |
| PUBLIC HEALTH | 16 | 8 | 24 | 141 | 5.8 | 0 | 99 | 0 |
| COMMUNICATIVE DISORDERS | 4 | 4 | 8 | 31 | 3.8 | 0 | 40 | 0 |
| HUMANITIES & SOCIAL SCI. | 40 | 253 | 293 | 6323 | 21.6 | 13 | 6213 | 477.9 |
| ART | 0 | 3 | 3 | 294 | 98 | 0 | 286 | 0 |
| ENGLISH | 0 | 31 | 31 | 1178 | 38 | 0 | 1185 | 0 |
| FOREIGN LANGUAGES | 1 | 4 | 5 | 768 | 153.6 | 0 | 768 | 0 |
| MUSIC | 0 | 1 | 1 | 330 | 330 | 0 | 289 | 0 |
| NAVY | 0 | 2 | 2 | 37 | 18.5 | 0 | 41 | 0 |
| PHILOSOPHY | 0 | 5 | 5 | 261 | 52.2 | 0 | 264 | 0 |
| RELIGIOUS STUDIES | 0 | 0 | 0 | 82 | 0 | 0 | 76 | 0 |
| SBS LAB | 10 | 82 | 92 | 0 | 0 | 5 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SOUTHERN STUDIES | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| THEATRE & SPEECH | 0 | 0 | 0 | 233 | 0 | 0 | 213 | 0 |
| | | | | | | | | |
| AEROSPACE STUDIES | 0 | 0 | 0 | 18 | 0 | 0 | 25 | 0 |
| ARMY ROTC | 0 | 0 | 0 | 18 | 0 | 0 | 18 | 0 |
| ANTHROPOLOGY | 2 | 3 | 5 | 111 | 22.2 | 0 | 126 | 0 |
| GEOGRAPHY | 6 | 12 | 18 | 217 | 12.1 | 0 | 210 | 0 |
| GINT | 3 | 5 | 8 | 668 | 83.5 | 0 | 737 | 0 |
| HISTORY | 0 | 12 | 12 | 844 | 70.3 | 0 | 862 | 0 |
| PSYCHOLOGY | 12 | 86 | 98 | 895 | 9.1 | 8 | 787 | 98.4 |
| SOCIOLOGY | 6 | 6 | 12 | 349 | 29.1 | 0 | 318 | 0 |
| HSSI | 0 | 0 | 0 | 20 | 0 | 0 | 8 | 0 |
| | | | | | | | | |
| SCIENCE & MATH | 17 | 134 | 151 | 3253 | 21.5 | 17 | 3428 | 201.6 |
| | | | | | | | | |
| REMOTE 1 | 9 | 44 | 53 | 1649 | 31.1 | 8 | 1643 | 205.4 |
| BIOLOGY | | | | 683 | | | 669 | 0 |
| CHEMESTRY | | | | 515 | | | 584 | 0 |
| PHYSICS & ASTRONOMY | | | | 451 | | | 390 | 0 |
| | | | | | | | | |
| REMOTE 43 | 8 | 90 | 98 | 1604 | 16.4 | 9 | 1785 | 198.3 |
| GEOLOGY | | | | 249 | | | 345 | 0 |
| COMPUTER SCIENCE | | | | 283 | | | 378 | 0 |
| MATHEMATICS | | | | 935 | | | 947 | 0 |
| STATISTICS | | | | 137 | | | 115 | 0 |
| | | | | | | | | |
| APPLIED PROF. SCIENCES | 23 | 31 | 54 | 752 | 13.9 | 0 | 1468 | 0 |
| BUSINESS ADMINISTRATION | 40 | 88 | 128 | 2888 | 22.6 | 14 | 2845 | 203.1 |
| CRIMINAL JUSTICE | 6 | 31 | 37 | 168 | 4.5 | 0 | 176 | 0 |
| EDUCATION | 5 | 30 | 35 | 1193 | 3.4 | 0 | 1494 | 0 |
| ENGINEERING | 200 | 20 | 220 | 734 | 3.3 | 0 | 779 | 0 |
| COLLEGE OF JOURNALISM | 4 | 25 | 29 | 287 | 9.9 | 0 | 352 | 0 |
| LIBRARY & INFO. SCIENCE | 3 | 18 | 21 | 135 | 6.4 | 0 | 81 | 0 |
| COLLEGE OF SOCIAL WORK | 1 | 9 | 10 | 232 | 23.2 | 0 | 149 | 0 |
| UNIVERSITY 101 | 2 | 3 | 5 | 220 | 44 | 0 | 162 | 0 |
| LAW SCHOOL | 8 | 2 | 10 | 785 | 78.5 | 0 | 770 | 0 |
| TOTAL | 398 | 706 | 1104 | 18245 | 16.5 | 46 | 19125 | 415.8 |

Individual cost center directors have the opportunity to prioritize new needs based on their own or some other cost center margin above revenue projections and include positive revenue positions in areas such as long distance billing.

Furthermore, the dependency on revenue to meet expenditure commitments and for new ventures is reviewed from an operational relationship perspective. Which is to say very little occurs where less than two cost centers are not involved in the support of a project. Projects are analyzed in terms of available resources and user benefits and the margin of gain in the revenue stream. In most cases the revenue is shared by multiple cost centers based on a percentage established according to the level of support provided.

The awareness of how our information technology operates has resulted in constant inquiry regarding our services. This not only applies to development and production projects but to the level of assisting in obtaining better rates in areas such as private lease lines for end users. In this particular case end user costs were reduced by as much as 40% and our revenue for that effort was 15% of the savings.

Although a sophisticated billing and accounting system is a prerequisite for this project the benefits are clear.

1. The University has 50% more technical resources available than would otherwise exist.
2. Cost center directors not only manage technology but as well manage their units destiny within the parameters of our goals and missions.
3. The spirit of it is business and entrepreneuralism has established a motivation within groups and individals that translates into "we can grow as much as we want and are not constrained by a lack of funding." (In most cases this expands the opportunity to enhance the magnitude of knowledge in the latest technologies).
4. There are opportunities for economical gains by individuals if projects are undertaken where substantial time and effort is required of staff members' personal time and is over and above his/her regular job tasks and expectations. (This is an identified and negotiated matter before any such efforts). It should be noted, however, that since this was initiated attrition has dropped from about 25% to 12% per annum.
5. The availability of such revenue has expanded the benefits of off-site training, technical conferences and in-house get togethers, all of which contribute to the gains achieved and staff morale.

We are frequently asked, "Why do you do this?" The response is simple. If you do not grow you cannot meet the needs of the institution and it is unlikely you can expand technologically without sufficient funds. With appropriation unequal to the demand we can either wait for additional funding or take the responsibility of supplementing the appropriation in sufficient amounts to accommodate the technical needs. For those of us who have enough funds to meet our needs, we are fortunate. For those of us who do not, this is an example of one course of action. It is demanding, sometimes precarious but is also fun and rewarding for you, your staff and your institution.

# PROTOTYPES AND SIMULATIONS AS DECISION TOOLS: INCREASING THE SOFTWARE IMPLEMENTATION SUCCESS RATIO

Elliott J. Haugen
Brian P. Nedwek

Saint Louis University
St. Louis, Missouri

## ABSTRACT

Implementation of purchased administrative software requires design and decision testing strategies focused differently than in traditional software development projects. Although vendor-developed software may closely match an institution's needs, there are still significant project challenges. Purchase decisions often do not/cannot include rigorous analysis of institutional policy and procedural implications. Successful system integration, within the context of policies and procedures, suggests the need for decision verification tools.

This paper describes efforts to bridge the software-context gap through the use of prototyping and simulations. These design/decision testing approaches were used in a recent student information system implementation. A prototype was used to orient project teams to software capability, to test data base decisions, to bring meaning to the developing product, and to transfer the focus from a technical to user orientation. Simulations helped validate policy, procedural and software decisions and interactions from both the service provider and client group perspectives.

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# Prototypes and Simulations as Decision Tools: Increasing the Software Implementation Success Ratio

## INTRODUCTION:

The evaluation and use of purchased administrative software within higher education institutions is an obvious and accelerating trend. Purchased systems have thrived as alternatives to traditional system developments due to increased functionality, data base capabilities, cost-effectiveness and access to more timely solutions. While vendor-developed software may closely match an institution's needs, there remain significant implementation management challenges. Especially problematic is a project's early, and appropriate, emphasis on software product evaluation and selection. Purchase decisions often do not and cannot include rigorous analysis of institutional policy and procedural implications. Successful implementation of a purchased software system depends, therefore, upon its integration within the context of institutional policies, procedures and organizational culture. This requirement suggests the need for design and implementation decision verification strategies which can be systematically applied to validate the impact upon existing and changed policies, procedures and organizational norms and values.

One approach to bridging the software-context gap is through the use of software system prototyping and process simulations. These design/decision testing approaches were used by Saint Louis University in a recent student information system implementation. A prototype was used to promote team members' understanding of the software capabilities, to test design and data base decisions, to bring meaning to the developing system and to transfer the focus from a technical to user/policy/procedure orientation. A simulation, in the form of a complete mock registration process, helped test policies and procedures from both the system development team and user group perspectives.

## BACKGROUND:

Saint Louis University is a private, liberal arts institution dedicated to the Jesuit tradition of education. The University, founded in 1818, is the oldest university west of the Mississippi, enrolls over 10,000 students and employs 4,000 full-time and part-time faculty and staff. The University consists of the Frost campus, Medical Center/University Hospitals and Parks College in Cahokia, Illinois. Academic offerings include undergraduate, graduate and professional programs, medical school, law school, Parks College (aerospace and avionics) and affiliated programs in Spain and France.

In 1984 the University began a major effort to upgrade its administrative information systems. New software and hardware systems were purchased and successfully installed into production for financial accounting (July, 1985), alumni/development (July, 1985), payroll/personnel (December, 1985) and student information management (October, 1987). These systems use Information Associates' Series Z (FRS, ADS, HRS, SIS) software running on three Digital Equipment Corp. (DEC) computers (VAX 8530, 11/785, 11/750) linked under a VAXCluster architecture. Over 200 workstations (terminals and microcomputers) are connected to these on-line, integrated data base systems.

## IMPLEMENTATION CHALLENGES:

Saint Louis University (SLU) began implementation of a University-wide student information management system (SIMS) in 1986. Papers describing software selection, previously installed systems (FRS, ADS, HRS), project organization and computing implications have been presented at CUMREC85 and CAUSE85. This paper explains how specific design and testing techniques can be used to evaluate and refine implementation plans and decisions as to their impact upon, and interaction with, institutional policies and procedures.

Implementation of a student information system is an institution's most complex computing challenge. It includes multiple components (admissions, student records, billing/receivables, financial aid management, housing, institutional research) and involves more people. It extends data base access and functional responsibilities further into the user community and at an earlier stage than other information systems. The "go-live" process is also more complex due to multiple subsystems. SIMS went live September 24 for the schedule of classes; October 26 for on-line early registration (11 sites, 25 workstations); October 27 for undergraduate admissions (6 other offices followed); November 2 for cashiering; December 5 for tuition calculation and billing; and December 14 for financial aid. SIMS also encompassed three campuses and several academic calendars (semester, trimester, year).

The SIMS project was organized around a project director, four implementation teams for the functional components, and a core team responsible for shared data elements, reporting and institutional research requirements. User-led teams consisted of users and computing professionals.

A successful selection/purchase process should result in implementation as closely as possible to the delivered base software. The import of picking a "best" package is lessened if excessive customization is a perceived need. Conversely, one must not ignore the fact that purchased software is not an "off-the-shelf" solution and implementation must be viewed as a system development process. Software design and programming tasks are eliminated, but system development must still provide an "institutionalized" solution which integrates the software and data base with policies, procedures and needs. SLU committed very early to a minimum-customization implementation. This increased the importance of team members thoroughly understanding the product's features and capabilities; it also reduced expectations that the software would be changed to fit individual nuances or old practices.

As the project implementation began, two basic categories of tasks began to surface: software-related and data-related. Initial issues and questions were software focused due to the team members early exposure to software selection and vendor software orientation. Although each team was involved in documenting current practice and policy, the software bias threatened user participation by tending to concentrate on technical rather than functional requirements. The data-related tasks began as data conversion planning, but quickly developed into procedural, training, forms and reporting objectives. Figure 1 summarizes major project tasks cast against a project window representing time and effort. This task versus time grid becomes three dimensional when integrated with institutional requirements in the form or management, operational and information needs; existing and changed policies and procedures; and implementation constraints (schedule, personnel, budget).

MAJOR SIMS PROJECT IMPLEMENTATION TASKS
RELATIONSHIP of EFFORT vs TIME LINE

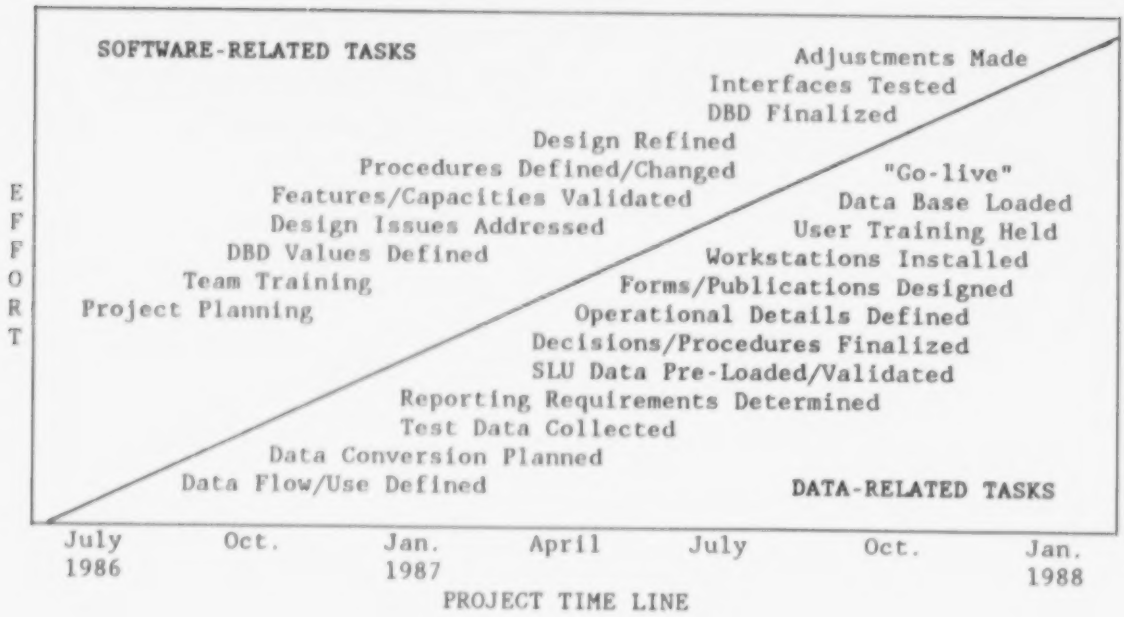


Figure 1

Four major project management challenges were envisioned during the planning stages or developed early in the implementation process:

1. How to foster a thorough understanding of the software's functional features, internalized within the context of desired outcomes.

2. How to transform the participant's orientation from a technical and software focus to a user/procedural emphasis; or how to move from the software-related tasks (which would diminish with time) to data-related tasks which would comprise the most substantial future workload.

3. How to guide the five concentrated, parallel team development efforts toward convergence into a single, integrated, and efficient solution; and how to provide a means to identify and address policy and procedure assumptions, cultural conflicts and differences of views.

4. How to test design decisions, software solutions and procedural changes thus increasing the project success ratio (reducing risk of failure).

The first two challenges generally do not exist in a traditional system development, but significantly compound the complications inherent in the last two concerns. The University addressed all four project management issues by utilizing two specific system development strategies: prototyping and simulations. These tools are not new, but their systematic application within a purchased system implementation may have been. Nevertheless, these tools provided valuable design and decision evaluation forces for alleviating obstacles and accomplishing project goals.

## PROTOTYPING:

The use of prototyping as a system development tool has grown considerably in the last few years. While usually associated with traditional system development efforts, prototyping also has application within a purchased software implementation. Prototyping has been defined as the creation of a "working model of automated information processes which begins as a trivial representation, and evolves into a full-scale functional information system" (Little and Lowry, 1985). Other definitions emphasis benefits such as greater user involvement in the development process thus fostering ownership of the application project. Lately, discussions have focused on the numerous prototyping tools, such as 4GL's, CASE (Computer-Aided Software Engineering), code generators and screen builders. However, recent studies at the State University of New York at Buffalo suggest the usefulness of prototyping is diminished if the development process itself is not well understood or is overshadowed by the software tools themselves. It was noted that "Systems developers are so enthralled by today's graphic, narrative, and representational modeling aids that they are losing sight of their mission and forgetting that the map is *not* the territory." (DATAMATION,1987).

Saint Louis University utilized prototyping as a development tool in its SIMS project to integrate the purchased software and associated training with system analysis requirements and to develop a final product focus. This formal 3-month team effort started shortly after training, not as a training extension, but as a tool to finalize and test decisions. A prototype was created combining the purchased software with a functional SLU data base and operationalized according to institutional policy and procedural decisions. It supported all activities of the specific functional areas (student records, billing, etc.), although not for all colleges, courses, terms, students, etc. Within pre-determined parameters, the prototype was developed to be a fully functioning SLU student information management system.

A copy of the base (training) software was loaded with SLU data base values for a defined subset of SLU courses, colleges, students and financial conditions. The prototype effort paralleled actual semester activities and used SIMS processes to test term schedules, sessions and calendars; course schedules; multiple sectioning; department/subject redundancy; admissions; registration procedures; student schedule printing; tuition calculation; residence/board charges; financial aid awards and disbursement; registration cancellations, drop/adds and withdrawals; refunding; GPA initialization and calculation; grading and changing grades; transcripting; standard and ad hoc reporting; plus other system (FRS, HRS) interfaces.

A common orientation early in a software implementation effort is that a system must work under all conditions and all cases, or it does not work at all. This misplaced perfectionism, or paralysis by analysis mode, is a major obstacle to development progress, i.e. all step 1 tasks and problems must be completely solved before step 2 issues are addressed. Prototyping overcame this problem and affirmed the 90-10 rule -- if the initial design worked for 90% of the cases, then future time could be focused on the remaining 10%. There were three other important outcomes: decisions were forced, procedural assumptions disappeared, and teams were sensitized to the importance of interteam coordination and communication. Prototyping verified which designs and decisions worked, but most importantly, made known what wasn't known.

## SIMULATIONS:

The formative evaluation of systems and procedures using a robust simulation was another key factor in the SIMS implementation. A simulated registration using students and office personnel was held to test final design, decisions, processes, procedures and documents/forms. The results of these tests were used to further refine the systems for the "go-live" stage.

Planning the simulation required the development of four distinct yet interrelated components. The first component involved goal specification, i.e., stating specifically what was to be accomplished through the simulation. The process by which test goals were articulated called for each team to submit a list of the SIMS data base elements and transactions to be tested. This step was followed by a series of team leader meetings where the test agenda was synthesized. Four goal sets resulted:

1. Test the software in a variety of applications, e.g., cross-listed and co-requisite course requests, tuition calculation under various combinations of college rates, fees, etc.; posting of payments against tuition charges, fees and outstanding balances.

2. Test basic processes and procedures, e.g., course conflict resolution; timing of registration episodes including completion of a registration form, registration confirmation, billing, receipting, financial arrangement processing; payments made by cash, check or third party sponsors; and authorization signatures.

3. Evaluate basic documentation and forms, e.g., schedule of classes, registration form, instructional materials for advisors and students. Assess user understanding, satisfaction, ease of use and common errors.

4. Test administrative support processes and procedures, e.g., the quality of staff instructions and training; type and frequency of data entry errors; staff response to questions from users; tuition charges reconciled to income accounts; and among others, hardware performance (computer response time, terminals, printers).

The second planning component involved development of a linkage between these test goals and the mock registration. The primary linkage was through the creation of 100 student biographies. Each biography reflected a combination of the following characteristics:

| | | |
|---|---|---|
| 1. | Student Type | Undergraduate, graduate or professional |
| 2. | College | Academic unit wherein the student was enrolled |
| 3. | Classification | Year in school e.g., freshman, first year law, etc. |
| 4. | Major | Key to selecting courses, including "required" |
| 5. | Special Tuition | Rates applicable to distinctive programs |
| 6. | Credit Hours | Total number of credit hours requested |
| 7. | Time Status | Full or part-time student status based on load |
| 8. | Dormitory | Residence and meal plan variations |
| 9. | Open Balance | Amount of open balance prior to registration |
| 10. | Payment Plan | Pay full amount due or use budget payment plan |
| 11. | Payment | Amount and method, e.g., cash, check, third party |
| 12. | Financial Aid | Whether or not the student received financial aid |

A biographical sketch was given to each participant as a student role to play in the simulation. The proportion of biographies with similar characteristics, e.g., full-time Arts and Sciences students receiving financial aid, approximated actual registrations in recent semesters (Kalsbeek, 1987).

The third planning component involved "seeding" the simulation to test the software and staff behavior. Some student biographies included instructions to register for certain courses thus creating combinations that should have been unacceptable, e.g., an undergraduate student requesting a course from a professional program. Responses to system messages by registration staff and students were monitored. Course offerings were also seeded. Errors in the Schedule of Classes were used to assess how the software and personnel responded to various system messages that appeared at the workstation terminals. Courses were set with enrollment limits to test the usefulness of standard reports, e.g., closed section and demand data.

While testing the software was a high priority, assessment of the actual flow of registrations was critical. Given the limited number (100) of registrations available, two sets of registrations were prepared in the event a "load leveling" intervention would be needed. This contingency plan would provide students with a filled-out registration form to be taken directly to a registration station to assure a relatively even flow of registrations; the simulated registration ran so successfully, this plan was not necessary.

The fourth component involved site selection, registration artifact creation and participant recruitment. A balance was struck between the need to simulate the physical environment of past registrations, e.g., ballroom style registration and the need to manage the evaluation component of the simulation. As a result, a miniaturization of the ballroom format was achieved with the number of workstations at each function proportionate to the past number of registrations serviced during a typical General Registration period. Personnel from the functional offices were trained and staffed the various stations. Registration artifacts included the use of "play" money, temporary student ID's and simulated checking accounts.

Participant recruitment attempted to achieve two goals. Not only were articulate students from a variety of backgrounds sought to participate and provide feedback, but also an attempt was made to create "interest" in SIMS among student leadership. Because of the latter goal, the main source of recruits was a student leadership organization. It was anticipated that such students might become trained aids for the actual registration. For various reasons, the number of student leaders recruited was below test needs. Additional recruits were obtained from summer school attendees and student employees. In July, 30 student volunteers attended an orientation session and were given instructions as to their roles and "identities". Three hours later, 100 registrations had been processed. The volunteers were compensated with gift certificates and dinner after the evaluative debriefing session.

## Evaluation Plan

Evaluation of the simulation was organized around four components. The first component called for the measurement of the amount of time needed to complete a registration. A model of anticipated processing times had been prepared, but required validation. Timers unobtrusively recorded the amount

of time required for a student to complete a particular episode, e.g., obtain a confirmed student schedule, obtain a printed bill and make a payment to a cashier.

The second component of the evaluation plan called for the application of a focus group technique to obtain registrants' expressions of their experiences. Long used as a qualitative marketing research tool (Calder, 1977), this technique was used as an exploratory approach to student perceptions of the registration. It was intended to generate a kind of prescientific knowledge of the registration episodes. This knowledge was compared with the quantitative data yielded from registration timing.

Each focus group was composed of seven registration participants and a moderator who had been trained and provided with a discussion guide. Each group session lasted approximately one hour and fifteen minutes and was audio recorded. A transcription of each session was prepared for the project team leaders and moderators completed thumbnail sketchs of their groups.

The third component of the plan included development of various reports from user groups. For example, reports were prepared on tests run after the mock registration, e.g., comparing cash register check-out against opening totals, amount and number of financial aid disbursements, and the like.

The final component of the plan included student responses to questions about each registration they had experienced. As each student completed a registration, they returned to the staging area to obtain their next biography. At this time they were provided a feedback sheet to record their initial impressions of what had occurred during their registration episode.

The Results

Timing results for registration episodes were relatively straightforward and described such characteristics as (1) average time spent at a registration station during the initial interaction (it was possible for some students to appear at a registration station more than once to complete a registration); (2) average duration of subsequent registration interactions; (3) average time of combined interactions; (4) average time spent in student accounts; and (5) average time spent at the cashier's station. Additional analyses were planned, e.g., average time of episode by type of registrant, but minimal variation in the length of each episode stayed further analyses.

Transcriptions from each focus group session and student comments on feedback sheets provided two more sources of data. The transcripts provided a rich source of feedback information about participant perceptions of the processes and procedures. A typical student response was:

> "The only problem was that you don't have a copy of your original (registration form) to compare it with what you get out of the computer and I was just wondering if when you're registering, are you going to be able to tell when they're typing it in if it's the same class or not....[T]he alternate section (of the registration form) was very helpful because there was one time where a class was cancelled and there were no other sections offered so they went to the alternate courses and it helped."

The fourth source of data was derived from analyses of work samples or post-simulation testing by each team. For example, students who were scheduled to receive financial aid were compared with the actual registrations. Some teams had planned to test the capacity of the system to generate standard reports, e.g., class lists; but limited resources and time pressures made such evaluations little more than ritualistic.

Translating Results Into Decisions

The mock registration began as an attempt to validate the design assumptions underlying SIMS. The implicit process by which these validations were to occur was a form of classic rational deliberation. Under these conditions, team leaders were to measure system performance against the basic design. The evaluation was to assess fidelity to design. In a sense, the effort might well be described as a ceremony of celebrating the faithfulness of field operations to the design. This activity, or rite, is intended to maintain the existing organizational culture (Trice and Beyer, 1985).

While changes in process, procedure and form that occurred after the simulation can be described, a more important lesson is the process by which these changes were decided. For example, the decision to have a single ply registration form to be retained by the student and similar form decisions, really did not occur in any formal way. Rather sense impressions gathered through the experiences of the simulation, coupled with the transcriptions of the focus group sessions were transformed into the everyday language of the team leaders. Thus, as the project moved toward the final stage, changes appeared as happenings more so than as the result of formal deliberations.

The degree to which the mock registration "fit" the design could have been the consuming agenda in the days immediately after the simulation. Were the teams to have applied a traditional deductive model, precious time would have been lost, frustration increased, and morale depleted. What occurred was that decision refinements simply happened.

Subsequent SIMS team leader meetings and formal and informal gatherings are perhaps better described by "how rules, rather than guiding this process, emerge from it" (Garfinkel, 1967 in Brown, 1978 p. 369). That is, decisions began to happen and were followed by their rationale. In a sense, results were not "translated" into action; results were the actions! The heightened intensity of the SIMS project that resulted from the simulation appeared to transform the teams into what has been described as a "high performing system." In such systems, "...people actually agree, without going through the tortuous processes of negotiation and conflict management" (Vaill, 1981, p. 35).

The mock registration process unshackled the immobility or malaise so frequently experienced following the intense design stage of project implementation (Haugen, 1985). Teams lost their fear of failure and gained a vision of success. Interestingly enough, the design was so complete and the results so successful that project management decided to expand the planned number of registration sites and workstations. This success was realized because the simulated processes were viewed as a final test of decisions and developed solutions. Just as the prototype initiated a reality of an institutionalized system, the mock registration confirmed its completeness.

**SUMMARY:**

The use of prototyping and simulations as decision verification tools has been shown to have both intended and unintended consequences for project management. The prototype strengthened project teams' understanding of software capabilities, allowed members to internalize the linkages between processes and software elements, and transferred the focus from a technical to user orientation. The simulations validated policies and procedures from both service provider and client group perspectives. The use of these decision tools had the unintended consequences of strengthening morale, heightening confidence levels, energizing user training, and providing the momentum to move the project into the final phases of implementation.

## REFERENCES

Bachich, Frank and Hester, P. Lawrence. "Institutional Change - A Fast Track Approach." CAUSE85 Proceedings, December 1985, pp. 187-197.

Brown, Richard Harvey. "Bureaucracy as Praxis: Toward a Political Phenomenology of Formal Organizations." Administrative Science Quarterly, Volume 23, September 1978, pp. 365-381.

Calder, Bobby J. "Focus Groups and the Nature of Qualitative Marketing Research." Journal of Marketing Research, Volume XIV, August 1977, pp. 353-364.

Canada, H. and Heard, E. "Toward the Procurement of an Administrative Software System: A Selection and Group Process." CUMREC85 Proceedings, April 1985, pp. 313-317.

Garfinkel, Harold. Studies in Ethnomethodology. Englewood Cliffs, N.J.: Prentice-Hall, 1967.

Haugen, Elliott. "Implementation of Purchased Administrative Software and Its Impact on the Computing Organization." CAUSE85 Proceedings, December 1985, pp. 457-467.

Kalsbeek, David H. Unpublished management reports, St.Louis University, 1987.

Little, Robert and Lowry, Christina. "The Perils of Prototyping." CAUSE/EFFECT, July 1985, pp. 4-7.

Trice, H. and Beyer, J. "Using Six Organizational Rites to Change Culture." in R.H. Kilmann, J.J. Saxton, R. Serpa, and Associates (eds.), Gaining Control of the Corporate Culture. San Francisco: Josey-Bass, 1985.

Vaill, Peter B. "The Purposing of High Performing Systems." A paper presented at the Conference on Administrative Leadership: New Perspectives on Theory and Practice. Urbana, Illinois: University of Illinois, July 1981.

Whieldon, David. "Prototyping: Shortcut to Applications." Computer Decisions, June 1984, pp. 138-147.

"Why Software Prototyping Works." DATAMATION, August 1987, pp. 97-103.

# ADMINISTRATIVE AND STRATEGIC COMPUTING

Dr. Ronald L. Moore
Vice President for Information Technology
University of Louisville
Louisville, KY

Dr. Frank B. Thomas
Director of Computer Services
University of Akron
Akron, OH

## ABSTRACT

Information is one of the basic resources available to the manager, just as valuable as human, material or financial resources. The ability to provide information depends on the files and data that is captured and stored. This paper will discuss the files needed to manage a large university and the tasks required to extract the data into information. To obtain this goal, there must be a strategic plan.

Management Information Systems is no more important than strategic computing. The evolution of the MIS concept from an initial focus on data through expert systems, decision, support systems, artificial intelligence and the ingredients for strategic computing will be discussed.

## INTRODUCTION

Information is the most important asset we can have when it is necessary to make management decisions that involve the expenditure of large sums of monies for the labor and materials required to produce a product. In other words, what we know about the business cycle of our business can only help us in making good decisions. Maintaining our business data and producing information is what Management Information Systems is all about. We can't have this information unless we plan for it. Understanding what data we should capture into what files and how they are interrelated is important. Why? Because it is the capturing of this data over time, the history of our business transactions that allows us to obtain the information we need to forecast our future business. If we don't capture it, then we don't have the data that is necessary for providing us this wealth of information.

Since our product is the education of students, we will concentrate on the needs for providing information at the operational and management level of a two or four year institution.

## DEVELOPING SYSTEMS 1970 THROUGH 1980

The building of a total management information system at the University of Akron started in 1965. The tools were simple with cards and magnetic tape the only available media and the language was COBOL. By 1974, we were looking at on line systems and the strategy was based on completing the systems required for selling our product first. That is, we had a plan to complete the student records area, payroll/personnel second and financial last. We did not at that time have a complete plan. Today we have a formal plan built on the structure of the organization. The systems we implement are managed through a total Project Management System that relies on good standards and procedures. That is to say that our systems are developed using the standard life cycle and estimates are made for each task within a development phase. At the end of each week, time is accrued and reported on each system under development.

The Job Accounting System is designed around the computer standards for system development and operational use. That is to say, our system naming standards that tie the system and all of its parts together are used with the Job Accounting System even to the point that the disk file names are tied to the Job Accounting charge number. At such time as the charge account number expires, the disk data set will be purged and backed up to tape. Yes, the files can be restored.

## WHAT FILES ARE NEEDED TO COMPLETE A MIS FOR COLLEGES AND UNIVERSITIES

If we want to build a total Management Information System, then we must look at the organization and analyze what files (data) must be present to do the systems required or the information that is needed to run the University at the operational and management levels.
A typical breakdown of the files required to support Student Records is as follows:

a. Student Master File
b. Student Course File
c. Master Course File
d. Section Master File
e. Grades/Transcripts
f. Graduation Sub File
g. Student Contract
h. Prerequisite
i. Student Account

The Admissions Office will require a Prospective Student File and access to the Student Master File to support their office. Alumni/Development need two files: a) Alumni Master and; b) Gifts/Pledges. To handle the space requirements for Planning, we need a Space Master File and Property Records. The Physical Plant will need a Requisition or Work Order Master File, a Time and Activity Master and an Inventory Master File. This subsystem must be integrated into the General Ledger for charge back.

The Computer Center requires a Work Order or Requisition Master File, a Time and Activity Master File, an Inventory Master File and a Project Management Master. The Library requires four files to make it a complete Management Information System, namely the Book Catalog, the Patron Master, the Circulation Master and the Book Acquisition. Financial Aids must have a Student Application and an Awards File, plus access to the Student Master File if they are to have a complete system. Human Resources requires five files: a Personnel Master, Payroll, Benefits, Faculty Activity and the Budget Position File. The Budget Position Master must interface with the Personnel, Payroll and Budget Master File.

In the Financial areas we need a Purchasing, Payables, Receivables, General Ledger and Budget Master with access to student files for a complete, integrated system. Naturally there are more possible files depending on whether you have a medical school or auxiliary enterprises. I did not illustrate the files needed for the Book Store, Food Service or other auxiliary enterprises.

HOW TO INTEGRATE THESE FILES BY SYSTEMS

It is easily shown that in the Student Records area we can register students with only the Student Master, Student Course, Master Course and Section Master Files. However, we can't check for prerequisites without the Prerequisite Master nor can we counsel students without a degree audit using a Contract Master, etc. What makes the complete, total Management Information System is the ability to add these subsystems that support registration (prerequisites) and advising (degree audit). Let's suppose we wanted to perform a degree audit; a contract file would be built at the time the student entered the college of his or her choice. At grade time, each course attempts in the contract file would be flagged as completed and a list of courses remaining could be printed. At degree time, the contract should be completed with no courses remaining in this file for the student to complete.

The graduation sub-file would be the file of all those students who have applied for graduation and this file will be used to pull the courses from the grade file and compared to the contract file the term before graduation. The graduate sub-file also can be used to determine the line of march and this file can be passed to the Alumni system for Alumni processing after graduation, etc. I could go on and on showing us how to integrate these files into a total Management Information System.

WHAT'S HAPPENING TODAY

Today we see a demand for information and one that must be satisfied within a short span of time. Users cannot wait for two or three days to obtain an answer to their question. If you have your systems developed using a data base language with a retrieved package, you are probably able to meet this

demand. If not, you need a fourth generation language like FOCUS or IMAGINE to bridge the files and allow you the ability to retrieve the data and not have to worry about file structure.

In effect, the building of a Management Information System requires the System Analyst to understand the organization, files and systems required to manage a large institution. To accomplish this, a good five year plan should be instituted.

The University of Akron formulated such a plan in early 1986. The strategy was to have a five year plan completed by April, 1986. In January, the President designated the Director of Computer Services as the Chairman of the Computer Planning and Policy Committee, whose body consisted of the Provost, Vice President for Business and Finance, one Dean, three faculty members and two administrators. The committee was in agreement that computing was too broad to look at as one whole entity. We divided the spectrum into six areas: 1) large academic mainframe computers; 2) mini and micro academic computing; 3) Computer Based Education; 4) Graphics; 5) Administrative Computing; 6) Networking; and 7) Office Automation. Several subcommittees were formed by selecting faculty and administrators most knowledgeable from their respective areas. The subcommittees interviewed faculty and administrators across campus, completing their reports by March of 1986. In April, the plan was developed with estimated costs for each area. The total plan was estimated at $12 million and today we have spent about $6.5 million. We have implemented the large academic mainframe recommendations and are presently working on the Office Automation, Networking and Administrative portions of the five-year plan. However, any plan requires monitoring and can expect change. We are now in our second year of the plan and working on updating the plan.

This leads us to a second area of concern: What about strategic computing?

## STRATEGIC COMPUTING

### IMPORTANCE OF INFORMATION MANAGEMENT

Information is one of the basic resources available to managers, just as valuable as human, material, or financial resources. It is hard to imagine the manager of today functioning without the use of sophisticated information management tools.

### INCREASING COMPLEXITY OF THE MANAGEMENT TASK

Management has always been a difficult task, but it is more today than ever before. The sheer size and complexity of the organization requires the use of information management systems. The current trend toward factory automation and robotics demands an ever increasing dependence on information systems.

The fast paced nature of today's business environment requires management to respond quickly to competitive pressures. Computer based management systems are the mechanism that allows managers to respond in a timely fashion.

All of these factors--size, complexity, technology, and competitive pressures--influence the management task. Information systems have become

central to the functioning of management in most organizations. The planning and implementation of such systems, can give the organization a competitive edge. Strategic, long range, planning of computer based systems is a crucial role for top administration.

## AVAILABILITY OF DECISION-MAKING TOOLS

Even as the manager's task has become more complex, there has been a movement under way to improve the effectiveness of decision making. Central to this movement are quantitative techniques and computers. Terms such as management information systems (MIS) and decision support systems (DSS) represent currently popular means of assisting the manager with computer-produced information. MIS refers to the overall application of the computer in a firm, with the emphasis on supporting management's information needs. DSS refers to efforts applied in a more focused way--on a particular problem faced by a particular manager.

## MANAGEMENT SKILLS

A successful manager needs to possess both decision-making and communications skills. Managers on all levels must decide on strategies, tactics, and operations. They also must communicate with persons reporting within and without the organization.

Today most middle managers have received some formal computer training. They are becoming more knowledgeable in computer basics and able to communicate with the computer professional. These managers and computer specialists can jointly develop computer-based systems to solve business problems. The new manager has an understanding of the strengths and weaknesses of the computer when applied to business problems and are able to use the computer as a decision support system.

## EVOLUTION OF MIS CONCEPT

It was not until the mid-fifties that computers were marketed on a widespread basis. Computers were used on a limited scale for processing accounting data rather than producing management information.

During the early sixties, information retrieval was developed. It was primarily concerned with storing, retrieving, and displaying information. Many of the systems of this era failed because management was overly ambitious. Firms erroneously believed that they could build a giant information system to support all levels of management.

The current focus is on decision support systems (DSS) and communications. The DSS provides support by actively involving the managers and providing analytical software to manipulate a data base. The MIS plays a more passive role by providing information that managers must interpret and apply at the operational level.

Since around 1980, interest has been aimed at office automation (OA). These systems seek to provide productivity gains through electronic communications. Office automation provides word processing, electronic mail, teleconferencing,

voice mail, electronic calendaring, document transmission, and other means of increasing office productivity.

The current focus is on the linking of articial (AI) intelligence and expert systems to the MIS. AI seeks to provide logical human reasoning by computer. Expert systems are a subset of artificial intelligence. Expert systems will eventually provide the primary link with DSS. Instead of DSS simply assisting the manager, the expert system will be able to suggest alternate ways to make a decision.

## ACHIEVING THE MIS

The manager is ultimately responsible for the MIS. The planning and control of information systems requires the involvement of top level management. New fourth generation software is easier for managers and end-users to use. This user friendly software has stimulated many users to do their own computing using on-line workstations. The microcomputer boom has also fueled this intense desire for end-user computing.

## INFORMATION NEEDS OF EXECUTIVES

Executives are different. An executive is not just a lower-level manager working on a higher level. The job changes drastically when the manager reaches the top. Top-level managers receive most of their information from subsystems. It is necessary to process lower-level data into useable information for top management. Any executive information system must take into account the special needs of top-level management for summary data as well as forecasting trends.

## STRATEGIC COMPUTING

The increased computer literacy of users and the ease with which users can acquire their own computing facilities have made many firms realize the need for a new corporate attitude toward computing. It is necessary for top management to devise long-range plans specifying information requirements and identifying the application of existing technology. Strategic computing requires the following ingredients:

1. The chief information officer (CIO) should report directly to the president.

2. A data administrator should establish and enforce policies and procedures on company data.

3. Information services department should have a documented understanding of data flow throughout the organization.

4. Long-range planning should identify information resource requirements.

5. CIO should establish organizational wide MIS policies.

## CONCLUSION

The combination of a good CIO that can manage data, set long range plans that include both the operational and top-level management, provide the capability to retrieve information using fourth generation level languages, three distribute networks and decision support systems is the basis for strategic computing.

# STANFORD JUMPS TO THE '90'S

## DISTRIBUTED PROGRAMMING

## PROMISING OR PREMATURE?

David J. Ernst
Stanford University

The paper outlines the growth and success of Stanford's centralized administrative systems programming organization, Information Services, over the past five years and the unique turn of events which have led to its decentralization into client offices during the latter half of 1987. Key reasons for the growth of the organization including joint reporting relationships with clients, a focus on building service and quality from the grass roots level, use of modern programming techniques, and an early and strong commitment to meeting the needs of campus departmental units are discussed. Of special interest is the way in which all of these attributes led to a predicable decentralization in the early 1990's which was accelerated during 1987 because of unforeseen factors. The challenge ahead for Stanford is to manage the problems created by this relatively sudden change in such a way as to "get a jump" on how to keep information systems functions in tune with client and technological requirements for the next decade--the "promise" of the distributed programming model.

## I. INTRODUCTION AND OUTLINE

What I present here is a review and analysis of recent events at Stanford University in the information systems arena. It is a study that I believe I have a professional obligation to present to this group of interested peers, but, I must admit, I would rather be listening to one of you tell about how it happened somewhere else! Let me begin, then with "Stanford Jumps to the 90's—Distributed Programming, Promising or Premature?"--or, as an alternate title: New mail on node VAXF from CUBLDR::PATTEE_D "Donna" "Stanford's Second Major Earthquake!"

During the course of this paper I will cover the following major areas:

--The Information Services Environment at Stanford in the 80's

--Key Milestones in I. S. Evolution Since 1980

--Changes in the Air—Early 1987

--Decisions Made and Directions Set

--Implementing the Decentralization Plan

--Prognosis for the Future

## II. THE INFORMATION SERVICES ENVIRONMENT AT STANFORD IN THE 80'S

It was clear by the late 70's that Stanford needed to overhaul its core administrative applications both to better meet client needs and to take advantage of new information technology. Thus, by 1980 the university had decided to proceed with major new development in the financial, student, and alumni and development areas. A search was also launched for a Director of Administrative Information Systems with a administrative user background rather than with a technical one.

The demand for more (and more articulate) "user involvement" was very strong. The existing Administrative Data Processing Services unit had an only partially-deserved reputation for taking too long to deliver applications and costing too much. The sense was that by the time ADPS delivered a product the client's needs had changed and he couldn't afford to pay for it. Users demanded to be more a part of the development process.

Greater flexibility in the systems design process with better modification

capability was essential. The concept of "iterative development" was emerging and being adopted at Stanford. This, coupled with the selection of a fourth generation data base management system with which to do all of the new applications development addressed both the flexibility and modification capability issues.

Another factor in the information services environment was the change in both the number and nature of IS clients. The traditional central administrative office clients like the Controller's and Registrar's offices were playing very active roles in the design and development process of their new applications. There was strong emphasis on the value of information and how it affected the quality, service, and productivity of the central offices. In addition, a new set of clients was surfacing as the departmental unit, both academic and administrative, came to be recognized as the real initiator and ultimate user of administrative data. At the same time the individual, particularly one with a terminal or PC, was seen as yet a third type of client, distinct from both the central office and the department.

By the latter half of the 1980's the departments had become an extremely strong factor in influencing the priorities of central administrative offices and of IS. They soon realized that the millions of dollars spent on "central systems" development in the previous five years hadn't given them all that they needed at the "departmental" applications level. The departments were ready for "their fair share" and weren't at all sure they would get it if it were to come out of the central computing organization.

III. KEY MILESTONES IN I.S. EVOLUTION SINCE 1980

In January of 1980 the Center for Information Technology (CIT) was formed to provide a single campus focus for all computing and information technology activities. Its formation indicated a strong commitment by university management to promote these functions via a single, central organization.

Early in 1982 the Administrative Information Systems (AIS) organization (as IS was called then) which was a part of CIT reorganized to reflect Stanford's own admistrative structure. Thus, AIS had units responsible for the Controller's Office, student systems, the Alumni and Development Office, the Hospital, etc.

In addition, the unpopular hourly programming rate was abolished and replaced with detailed annual budgets for each client area with clients paying for AIS services on a monthly basis according to the agreed-to budget. Another successful organizational strategy was the concept of joint reporting relationships where AIS Assistant Directors reported jointly to the AIS Director and to the head of their client area. For example, the Assistant Director for Financial Systems reported both to the Controller and to the Director of AIS. Borrowing from the legal concept of joint tenancy, each supervisor "owned" all of the Assistant Director. The Assistant Director would, in turn, supervise programming staff in the Controller's Office and in AIS. Since both staffs had the same "boss," much of the "we/they" attitude went away.

Later in 1982 the Stanford-developed SPIRES data base management system was chosen as the principle DBMS for development of the new central administrative applications. This decision came after months of study of the alternatives

and a firm conviction that a single DBMS in a "fourth generation language" would provide the best system integration, speed the development process, and involve the users to the greatest degree possible. At the time SPIRES and FOCUS were ranked similarly in the Stanford study, but in the end SPIRES was chosen because the staff supporting it were already in place on the campus and the future direction of SPIRES could be determined locally.

At the end of 1982, it was evident that some guiding principles were needed to integrate the several major development efforts that were going on simultaneously and to focus the campus on the ways in which administration at all levels could and should change once the new applications were in place. The "Administrative Systems Architecture" became the guiding concept around which the development effort took place. The Architecture was simple, easily understood, and in some ways, very subtle. At its center was the departmental unit surrounded by the central administrative offices with the whole connected by campus electronic networks. The basic tenent was that the department, both as originator and ultimate user of most administrative data, was the most important client of all. The department and its growing local computing capability had to be recognized as having perhaps the most critical stake in the so-called "central systems development." This fact, coupled with the growing realization that central administrative offices exist primarily to serve departments and not vice versa, influenced the way in which the new development was done and continues to influence today's information technology at Stanford. Although in some ways simplistic, the Architecture served to focus both technologist and line officer alike on the fact that the new development and the efforts that came after it had much less to do with computing than it did with the way in which people do their day-to-day administrative work.

1983 marked the beginning of the shift away from a single, large information technology organization to manage all of Stanford's efforts in this arena. In a move to bring "academic computing" closer to academic administration, academic computing consultation and academic networking support were shifted from the CIT organization and placed under an Associate Provost. CIT became ITS, or Information Technology Services, and inherited both Telecommunications and Graphics and Printing Services. While the Director of CIT reported to the Provost and two Vice Presidents, the Director of the new ITS (the same person, by the way) reported to the Vice President for Business and Finance and ITS became a part of the Business and Finance organization.

As personal computers proliferated on campus and the needs of departments became more evident, a group of professionals was organized in IS to provide support to departments at least commensurate with that being supplied to central administrative offices. This unit of IS was called Departmental Information Services (DIS) and was formed in 1984. DIS did extensive surveys of campus departments including several in depth studies of specific departments to assess and rank departmental needs and establish DIS staffing priorities accordingly. Over time DIS became expert in providing consultation and support to departments and individuals in the information technology arena. The group became the leading advocate for departmental and school information services support and continued until its elimination in 1987 to operate with a large backlog of consultation requests.

As the new applications development proceeded the need for a common user

interface came to the surface. While one set of commands used to access student data all day by an employee in the Registrar's Office was workable, a staff member in the Biology Department needed access to student, financial, purchasing, and alumni data all in a day's work. On-line access commands in each of these applications could differ widely even though they were all written using SPIRES. Thus, for most departmental employees different sets of commands would have to be learned for each application if they were to use the new systems. To overcome this problem, a single set of menu- driven commands was developed to cut across all major applications to facilitate use primarily at the department level. This interface, called "Prism," was introduced in 1984 and is widely used today at Stanford.

In 1985 development on the new applications was far enough along for the campus to begin testing departmental on-line entry and access to several kinds of data used in departmental administration. The Departmental Access Pilot Project was begun to open up access to several departments at no cost to them to gather data on what would be required to provide entry and access to all campus departments within the next few years. The pilot project resulted in a great deal of important data on costs, training requirements, and technical issues which formed the basis for planning the implementation of full access by the end of the decade. This would mark the ultimate implementation of the Administrative Systems Architecture.

By 1986 concern was growing among the central administrative offices that the new applications were costing more to run than they had anticipated. Most of the energy and attention related to budgeting for the new applications had focused on allocations for the development costs and, while several accurate projections had been made in 1982 on future operating costs, no one had paid much attention to them. As client computing budgets were overrun, fingers were pointed and scapegoats were sought, but the end result was a call for major cost reductions. Since most of the overspent budgets were for ITS computing charges, the principle target for cost cutting became the ITS organization. Ironically, DIS, which was funded almost totally from ITS mainframe revenue, came under heavy attack while providing some of the most popular ITS services to the growing departmental clientele. In the end, the political pressure was too great and DIS was sacrificed in August of 1987. Much of the time of the senior leadership of ITS from early 1986 until the organization was disbanded in mid-1987 was spent in budget reviews and program defense rather than information technology. Just how much was lost of the leadership role Stanford developed in this area in the five previous years during that 18 month period remains to be seen.

## IV. CHANGES IN THE AIR--EARLY 1987

Sometime in late 1986 or early 1987 the Stanford Provost reportedly began to examine the idea of pulling all information-related resources together under a new vice presidential organization. In this plan the ITS functions, those split off from CIT in 1983 and placed under an Associate Provost, and the Stanford University Libraries would be combined. The concept of including the libraries was not new, of course, given the experience at Columbia and elsewhere, but it had not been considered seriously at Stanford in the recent past. Rumor had it that the Provost thought the idea made a good deal of sense, but did not want to make the organizational move unless the libraries would go along. Apparently, he also did not believe that a new vice presidency

could be justified with only the ITS and Associate Provost areas included. Only a small circle of people knew the idea was being considered until early February when it became more widely known and some opposition began building in the libraries.

The Provost had also begun a gradual shift of reliance and emphasis from the Business and Finance organization. More and more staff work that had traditionally been done in Business and Finance or shared between that organization and the Provost's Office was now handled by the provostial areas. Long-time Stanford watchers noted the change to more symbolic and real management of the institution by the faculty and academic administrators.

By 1987 ITS was under heavy pressure to reduce its budget even after having made multi-million dollar reductions in 1985 and 1986. Lay offs were being considered and morale was at an all time low. More importantly, as far as the future of the organization was concerned, ITS was becoming a major liability to Business and Finance which had already witnessed its own star dimming. The fact that ITS was ultimately disbanded is as much attributable to its lowered status and reputation as it was to the Provost's desire to pursue the idea of a new vice presidency. Had ITS been a strong and popular organization within Business and Finance, it probably could have survived particularly given the fact the the libraries effectively kept themselves out of the Provost's plan.

Actually, the "downsizing" theme had been rolling across the campus for some time beginning with the Hospital in 1985. ITS was not alone in its budget cutting and other areas in Business and Finance were affected as well. Early in 1987 the concept of "smaller is better" seemed to be the most popular bandwagon making one wonder if some of the early ideas of the "junior Governor Brown" had acquired a new following.

V. DECISIONS MADE AND DIRECTIONS SET

In mid-March I met with the Vice President for Business and Finance, Bill Massy, and he said that he had just come from a meeting with the Provost and the establishment of a Vice President for Information Resources was a virtual certainty. The libraries would participate only to the extent of a coordinator in the new Vice President's staff, but ITS in its current form would be fully subsumbed by the VP-IR organization. The official date would be around July 1.

All of this information was basically known by most of us at this time and the meeting with Dr. Massy merely made it official. What he said next, however, came as a complete surprise. He told me that he believed it was probably time to split up IS as well and distribute the several programming groups to the central offices for which they provided service. His reasons centered around his belief that the new VP-IR did not have administrative computing high on his priority list and if IS were to become a part of IR, it might be neglected. He also stated that the clients probably wanted to get "their" programmers back at this point anyway. Massy said that although he was interested in my thoughts on the issue, he just could not see any good reason for holding the group (IS) together. I think this group of listeners won't be surprised when I say that my views diverged from those of the Vice President!

My initial reaction at this meeting with Dr. Massy was that I knew of no

client who wanted to supervise programmers and none were less than satisfied with the service they had been receiving from IS. As to the point that IS might be neglected in the new IR organization, I noted that we were basically self-sufficient anyway and had never relied on strong supervision from above or a collection of other technology-based organizations around us for success, much less survival. For that matter, if there were a concern for IS being a part of IR, why didn't Massy just keep us since we were still at that time a Business and Finance entity? I did agree to take the next two to three weeks to interview all our clients, most of the IS staff, and talk to some of my colleague IS directors at other institutions to see if I simply had lost touch with what was really going on with my own organization.

On April 26 I completed my review and reported back to Dr. Massy in a paper entitled: "The Role, Function, and Organization of Information Services." In a nutshell, I found that all of our clients believed that IS had served them well in the past and was continuing to do so. The weakest support came from a client who said that the plan to decentralize IS probably could work. The IS staff and many ITS staff who worked closely with us, were adamant about the need for the organization to stay as one. Many were curious as to why a functioning, well-run, and basically well-respected organization was being considered for demise. One staff member quipped: "It sounds like someone is saying: °It's fixed, let's break it!'" My discussions with other IS directors yielded surprise and concern that Stanford to whom many had looked for leadership in the IS arena, seemed to be bowing out of that position.

My primary recommendation to Vice President Massy was that IS stay together as one organization either within Business and Finance or moving into the new IR organization. Some of my reasons for this recommendation were:

--the economies of scale resulting from a single IS organization are significant and can be measured both in dollar and productivity terms

--programmers are more productive and effective as part of a larger professional peer group where ideas can be traded easily, organizational loyalty develops, and several career paths are available

--IS is in the height of its success, liked by its clients, with a devoted and loyal staff, and respected by its peer IS groups

--IS has remained within or below its budget for the past six years and, in fact, turned money back to its clients

--IS clients don't want "their programmers back"

--a better time for decentralization of IS would be in the early 90's when the systems development is completed and departments are fully on line

I concluded my report to Dr. Massy with the following:

> Information Services, in the spring of 1987, finds itself betwixt and between. Its people have worked hard to achieve the ability to facilitate, not hamper the business

of its clients and to do so while being as "invisible" as possible. It would be an unfortunate irony if IS has been so successfully invisible as to be considered unnecessary as an organization. This is not a view held by IS and, more importantly, it is not held by IS clients.

Vice President Massy committed his own thoughts to writing in a "Talking Paper on Administrative Computing Reorganization" in early May and used that as a basis for his own set of interviews with IS clients, staff, and others. He evaluated the then-current situation and had these findings:

--major administrative applications are nearly complete

--support for departments is critical, but progress has been unsatisfactory because "do-it-yourself" groups have sprung up to try and provide support

--there has been a lack of high-level (meaning vice and sub-vice presidential) attention to the business problem of local and central systems connectivity

--there is a need for comprehensive stratigic thinking, planning, and cost-benefit analysis for administrative systems and their role in productivity enhancement--this is a business, not a technical issue

The basic conclusions reached in the Massy paper were stated as:

* It is no longer necessary for applications programmer/analysts to report to a centralized technical organization in order to achieve acceptable technical outcomes. Decentralization of this function will enhance the focus on business issues and also eliminate much of the overhead of the central organization.

* Administrative system planning and development is part of the fabric of the line operating function. It cannot be effectively delegated to a centralized technical or information organization. (Of course the central organization can facilitate the process, as described below.) Line operations lacking in local understanding of administrative system principles and capabilities should develop appropriate internal resources as soon as possible, or else make arrangements for organizations with similar work processes to assist them.

* Strategic planning and oversight for administrative systems should be university business functions. Concentration should be on what work is needed and how it is to be performed, rather than on the more abstract concept of "information." This function should include determination of the scope and focus

of our various administrative systems, the boundaries between them, verification of the "ownership" of each system and the responsibilities of the owner, and the adjudication of data access issues where necessary.

* Not-with-standing the above, administrative systems planning, development, and refinement must continue to be closely linked to and well supported by technical and information resources. University-wide peergrouping of applications programmer/analyst personnel must be nurtured and utilized effectively; this function is best done by the new Information Resources organization.

A new organizational structure was proposed in the "talking paper" and discussed with clients and staff of IS. The key points of the new structure were:

--IS would be disbanded and the programmer units distributed to the line organizations

--the Software Acceptance and Quality Assurance unit would move to the Data Center in IR

--the administrative systems strategic planning function would move to the Vice President's office in Business and Finance

--a process would be established to facilitate programmer-analyst "peer grouping"

--a "Front Line Departmental Systems Group" would be established to develop, maintain, and enhance departmental administrative systems

--an "Administrative Productivity Council" would be formed to provide policy level leadership

After further discussion with clients, staff, and me Vice President Massy announced publicly on May 19 that he had decided to proceed with the structure he outlined in his talking paper.

I am reminded of a question from the audience during a panel discussion in which I participated at the Snowmass Conference over the past summer. I had been giving an abbreviated version of the contents to this paper to bring people up to date on what was going on at Stanford. A gentleman stood up and asked me how I knew it was time to decentralize IS at Stanford. I told him I knew because the Vice President for Business and Finance told me so--twice! May 19, 1987 was the second time.

VI. IMPLEMENTING THE DECENTRALIZATION PLAN

A transition team to implement the IS decentralization was formed in June and charged by Dr. Massy to complete the process by December 31. Members of the

team were the Director of the (new) Stanford Data Center, a staff member in the Business and Finance Management and Financial Planning office, and the Director of IS. We met weekly through August to deal with the transition issues and to keep the lines of communication open both within IS and between IS and other concerned organizations--particularly client organizations.

Several key issues arose during the transition period that are worth noting. First, in the budget area, we had to determine if the funding available to support IS in its centralized mode would be adquate to provide support to the several decentralized units. In addition, the new functions (strategic planning, "front line systems" and the like) outlined in the Massy paper had to be costed. Then, there would be the computing charges from the Stanford Data Center for 1987-88 that had not yet been estimated. All of these costs would have to be summed and compared to the known existing funding including the amounts previously used to fund the IS Director and his office which would "go away" under the new plan.

In the personnel and staffing arena, the principle issue was the determination of which staff would go with which client area. It wasn't as simple as just dividing up people based on the IS division breakdown because many programmers were split between two or more cost centers. Eventually we settled on distribution based first on the foreseeable maintenance and development needs of the several client areas matched against criteria of skill set mix, critical mass, and simple equity. Another issue was the spectre of layoffs as we tried to make sure all programmers and support staff were placed, but had no assurance that some wouldn't "fall between the cracks." Finally, we faced the need to announce all staff changes at the same time so that information about people's futures wasn't trickling out little by little. In the end, we announced a date upon which all IS staff would learn to whom they would report and where they would work.

Space was another issue that required our attention as the Massy paper called for the programmers to be located with the clients for whom they would be working. First we had to determine the requirements based on the programmer distribution plan and then evaluate the space available in the client areas. Needless to say, this issue was placed on the "back burner" until other items were settled. Space on the Stanford campus has the same volatility as it does on other university campuses!

Finally, and most importantly, were the morale issues. The IS staff was extremely agitated with the decision to proceed with decentralization. These concerns were building in intensity daily and it was essential that opportunities be provided for staff to express their concerns on a regular basis. The opportunities were made available for both public and private expression and interchange with a person or persons who knew what was the current situation. We worked hard to keep the information about the decentralization process flowing to the staff in electronic mail messages, through supervisors in staff meetings, and in regular social gatherings. The key was to keep the focus on the future and not let the general desire to hang on to the IS of the past postpone the inevitable. By maintaining a high visibility and availability of the IS Director and his Assistant Directors to the staff, severe productivity losses were avoided. Still, most of the summer of 1987 represented the lowest ebb in the output of the IS staff. Offices in the IS building that normally had lights burning well into the evening and on

weekends too, now were dark at 5 and rarely occupied on weekends. Staff morale was probably the single most important issue dealt with during the transition period.

The status of the IS decentralization in December of 1987 is that it is basically complete. The organizational and budgetary changes were accomplished on September 1. The IS staff is still occupying the same building with no new space to move to for at least one year. The Director's Office staff who were not transferred to client areas all have found new jobs. No layoffs were necessary and no one quit. Basically the consolidated IS budget was adequate to fund IS-type functions in the client areas and some new dollars were made available to fund the strategic planning and "front line departmental systems" initiatives. No action has yet been taken on the "Productivity Council." The IS organization will cease to exist, on schedule, on December 31, 1987.

## VII. PROGNOSIS FOR THE FUTURE

The events of 1987 are much too recent and, in fact, the results are still unfolding for any accurate post mortem to be done at this time. I believe it is much more important to focus on trends which led up to the IS decentralization than to worry about whether the same thing will happen on your campus. These trends and the way in which they are addressed can have a major impact on the role and the vitality of your IS organization, and, for that matter, of your institution.

First is the strong need to integrate the business functions with the applications supporting them. There is not the "work of the Controller's Office" and the "financial system." They should be one in the same or at least have that as the goal shared by the programming and the functional staffs.

Secondly, is the tendancy of some clients to let the IS staff make the decisions on how best to make the application support the business functions. We found that the point can actually be reached where a client and programming staff are so well integrated that the technical group may be "calling the shots" in some parts of the client business. It is an ironic twist from several years ago when we were all admonished to "learn the client business" and don't "talk techie" all the time. Many would argue that this degree of client/technical staff integration is admirable, but the lesson is not to let it be perceived as the client shirking its responsibility.

Third is the absolute necessity to pay attention to the schools and departments. Inevitably they will emerge as the prime force driving administrative systems and those responsible for them. IS at Stanford started chanting that theme (and doing something about it) in early 1983 and we could have done even more.

Finally, and perhaps most importantly for you IS types, is the need to develop a role for the IS organization beyond that of a simply technical group. The IS of the future will need to focus on the nature of administrative work and how information systems can make a difference in improving productivity and "working smarter" in client areas--especially departments.

There are several questions that will remain unanswered for some time as life in a decentralized environment evolves and evaluation of the results of the management decisions of 1987 begins. Some of these questions worth watching are:

--Will good programmers continue to work in an environment where the peer group has gone from 90 to 9 or less?

--How key was the existence of a strong, central IS organization to systems sharing, standards adherence, client cooperation, and the like?

--Will the "smaller is better" concept truly allow for coordinated, integrated approaches to meeting departmental information needs?

--Will the decentralized approach save dollars across the University or will all the new pieces add up to more than the orginal whole?

In closing, let me briefly state my personal opinion on the situation with IS at Stanford. My speech is titled "Stanford Jumps to the 90's" because much of the decentralization put into place over the past six months we had intended to do in the early 90's anyway. I do think, though, that we "jumped" too fast. My title also asks the question "Distributed Programming, Promising or Premature?" Simply put, I believe that distributed programming at Stanford University as instituted in 1987 is a promising idea prematurely implemented. But, then, that is only the personal opinion of one, soon to be emeritus, Director of Information Services.

As they say, "only time will tell" and the only fair way to end this story at this point is not with "the end," but with: "to be continued....."

# THE DIRECTOR DONS THE BANKERS CAP

or

# NEED A PC? HAVE I GOT A DEAL FOR YOU!

Arthur Brooks
University of Missouri - Rolla
Rolla, Missouri

With the introduction of the Personal Computer to the business world, images of a magical work producing box danced through the minds of the University departmental directors. At no time had a single piece of business equipment created such a near instant demand. The wondrous new computers dangled before the administrator's eyes like the golden ring on a merry-go-round. However, with budgets which barely met current office obligations, the new devices were well beyond the financial reach of most departments. In 1985 this campus of the University of Missouri instituted a self-funded Personal Computer loan program which allowed the departments to purchase PCs and repay the money over a forty-two month period of time. This paper describes the process created to manage the fund and relates the experiences gained from the program which is nearing the end of its third year of existence.

When the IBM Personal Computer was realized as a potential business tool in the early part of this decade, the University of Missouri - Rolla administrative departments were faced with a serious problem. Everyone seemed to want one of the new magical boxes, but very few people had the funds to finance the purchase. While the prices were attractive, the amount was simply more than any departmental budget could afford. As for fully justifying the purchase, no one really knew how they were going to use the new devices, they just knew they had to have one. To the departments, the new Personal Computers provided a sense of freedom from the dependence they had on University mainframe computers and computer programmers. This new device suddenly became a way to handle all of the office duties. No longer would they have to endure the routine of having their requested report put on a work priority by the computer center director. Then they had to wait while the programmer defined the report, wrote the program and finally produced the results. None of this seemed really necessary to the typical administrative user and it was a process the administrative user wished to eliminate. In the eyes of most directors, one of the new Personal Computers would save the department money, time, be more efficient and the results would impress their superiors. Who needed those computer people anyway?

Consequently, during the first year or two, there was a mad scramble to secure monetary assistance to buy PCs. Scarcely a department had the funds to purchase the desired equipment from their own accounts. They needed to seek the financial support of a higher level administrator. These administrative benefactors found their desks cluttered with proposals for the purchase of Personal Computers for the benefit of campus departments. With insufficient funds to satisfy all requests from campus units, these higher level administrators chose the proposals they determined to be in the best interest of the campus or their own administrative area. From this activity developed two distinct camps, the 'haves' and the 'have nots.' The fortunate group of campus units embarked on a flurry of activity with their newly acquired micro computers. They were too mired in the business of how to work these new tools to worry about the productivity of the machines and the reality of their ambitions. On the side lines, the 'have not' camp sat and watched the flurry of activity with much dismay. If only they had been chosen ....

In May of 1984, the Director of Administrative Data Processing (ADP) at UMR submitted a proposal which entertained the idea of designating a specified amount of campus money for the procurement of Personal Computers for campus administrative units. The concept was not a particularly new idea for other universities, but it was new to the University of Missouri. This plan was targeted to assist those campus departments who were currently renting computer terminals from the Computer Center, campus administrative divisions who had computer equipment rental as part of their existing budget. The desire was to be able to present to the administrative units an opportunity to replace their computer terminals with newer equipment while maintaining a near constant departmental budget. With this in mind, it was initially proposed the funds be made available to campus units on a

thirty-six month loan basis. The loans were to be repaid on a yearly basis, with a nominal interest being charged. By this approach a substantial portion of the 'have not' camp would be satisfied and the campus productivity, hopefully, would increased. The following arguments, supporting the self-funded loan concept, were presented to the Chancellor:

1. The number of departments purchasing PCs would increase, thereby addressing the Chancellor's stated desire to significantly boost the campus administrative computing activity.
2. In three years the Chancellor could receive his investment back, with interest. (A change from his funding equipment with no monetary return.)
3. Through time payment budgeting the departments could establish a method to extend their office configurations or upgrade their computer equipment when the current obligations were met.
4. The Chancellor could be assured this collection of departments would not be approaching him in a few years with requests for additional funds for PC replacements.
5. No departmental budget increases would be required to implement this plan.

In January, 1985, the Chancellor of the Rolla campus committed a sum of $70,000 for the use of purchasing Personal Computers for administrative departments. The details of the restrictions associated with the administration of this account was left to the discretion of the Director of Computing Activities - Rolla and the Director of Administrative Data Processing - Rolla. After due consideration it was determined by these two individuals that the users would repay the money on a forty-two month basis. There was a concern expressed regarding the users experiencing hardware difficulties and being faced with having to pay the cost of the repair. Of particular concern was the thought that some borrowers might attempt to return the PC to the campus computing entity rather than bearing the cost of repairing the device. At that point in time, the two individuals responsible for the fund were still not totally convinced the new devices would prove to last beyond the fad stage. Neither individual wished to accept the return of a device which they were not sure they could re-sell. Consequently, a monthly maintenance was included in the repayment schedule. While there was concern this item would increase the monthly repayment rate too much, it would handle the problem of PC repair. It was also stated with the early PC fund borrowers that the PCs were the property of the individual departments and the computing office of the campus would not accept the return of the equipment.

After considerable discussion the Director of Computing Activities and the Director of ADP established the policy that the loan fund borrowers would pay 13% simple interest and 16% for maintenance. Using these figures, a monthly loan payment amount was derived. Not wanting to deal with monthly statements, the Director of ADP, who was designated as the loan fund administrator, established the policy that all repayments would be made only once during the fiscal year. The

department's obligation was to start with the first full month after the PC was delivered and the department's obligation was due immediately for the current fiscal year. For each successive year, the PC time purchase repayments would be made at the beginning of the fiscal year. It was contended this procedure was in the best interest of both the fund and the department. If the University were to reduce budgets after the start of the fiscal year, the loan fund would not bear the effects of such cuts and the department would have protected their time payment obligation. This is a procedure which remained in effect for only the first year. Since that time the re-payments have been handled anytime during the fiscal year the department wishes to process the paper work. These payments have more frequently been paid at the end of the fiscal year.

A formal repayment schedule and loan stipulations statement were submitted to the borrowers with the first few purchases. Those stipulations included such statements as:

1. All payments were to be paid at the beginning of the fiscal year.
2. The PCs could not be returned to the Computer Center.
3. The devices were the property of the borrowing department.
4. If the borrower wished to sell the PC, the Administrative Data Processing department would attempt to help the department find a buyer, but ADP would not accept any responsibility for the device.

It was felt such statements were necessary for the computing entity of the campus as the micro computers in the office had not yet become a proven reality. The computing directors believed the computing entity had to afford itself some sort of protection from those departments who launched themselves into an area which they could not maintain. Obviously, there was a note of pessimism regarding the permanence of the PC in the office.

For a department to utilize this fund, the Director of ADP requires the potential borrowers to contact him with their needs for a Personal Computer. After determining the department's desired configuration, the ADP Director informs the department of the cost of the configuration they had jointly identified and the loan stipulations. Upon confirmation of the department's desire to time purchase a Personal Computer, the Director of ADP creates the proper University purchasing documents to purchase the defined configuration. In some instances the Director has been able to submit a single equipment bid for several departments, resulting in the University receiving lower component prices. Upon arrival of the equipment, the Director arranges for the installation of the new equipment by the campus Computer Center. All cost for equipment shipment and installation are borne by the time payment account.

Prior to the establishment of this program, the campus Computing Center had established a Personal Computer repair effort. It is this operation which is expected to perform all local maintenance efforts on the loan fund sponsored equipment. In order to identify time pur-

chase equipment when user departments call for PC repair, a label has been printed and placed on each time purchased system unit. On that label is printed a unique ADP equipment ID code, and the date maintenance is to expire (forty-two months from the date installed). When the campus technical staff repair a time-purchased PC they note the number on the label and forward the repair bill to the Office of Administrative Data Processing for payment. To this date this system has worked effectively. In the event the micro-computer technical department automates its inventory system, a bar code is included with the PC label.

In the last two years, an interesting spin-off from this loan fund has been observed. Being a public University, the campus departments are provided a fixed budget to be used during the current fiscal year. By state law, no campus account may have an end of fiscal year balance other than zero, except for specially approved revolving accounts. Positive balances in campus accounts are used to cover negative balances in other departments. It is left to the discretion of the director to see the departmental funds are appropriately used during the fiscal year. Upon the approach of the end of the fiscal year, campus administrators have traditionally scrambled to balance their department accounts. In years for which a surplus has been anticipated, this activity has meant the director had the luxury of purchasing some less essential items for the benefit of the department. In lean years this activity has meant a scrambling to find funds to cover departmental deficits.

Since the creation of the loan program, the departments on this campus, who have utilized our time payment account, have had greater flexibility in balancing their accounts. If they have monitored their spending activity judiciously enough to have an anticipated positive balance, some administrators have submitted an extra payment to the loan fund to pay for a portion or all of next year's PC obligation. Those directors who have been faced with a potential deficit have been allowed to place their PC repayment in hold for the current fiscal year. We have, therefore, seen a more creative form of departmental budgeting and have provided the campus with an alternative method for dealing with departmental fiscal year-end deficits.

To this date a number of the devices purchased during the first year of this fund have been paid in full. As they have paid off their time purchased equipment, some of the departments have purchased other devices, thereby keeping their departmental budget at a constant level while increasing the number of computers owned by their department. It was this very type of activity which had been envisioned when the loan program was initiated.

When this fund was created it was anticipated the PCs purchased would have no street value at the time of the loan maturity. It was not necessarily a pleasant thought, but one which the administrators of the fund felt at the time to be realistic. The advancement of technology during the last several years has been such that the value of most mainframe computers is a trifle portion of the original amount when the organization considers selling them in order to purchase newer machines. Considering the initial cost of Personal Computers,

the expectation was the micros would have to be viewed as disposable. They would have no market value when the loan matured.

It came as a substantial surprise this last spring when it was realized the old PCs did have a value. With the introduction of the new IBM PS series computer, the old PCs suddenly seemed to have an identifiable demand. There were departments on campus who had desires for purchasing a micro-computer, but did not feel they had the funds to buy a new one. Since the Personal System computers were priced at nearly the same price as the PCs of two years ago, some of the current PC owners were interested in purchasing the new devices if they could sell their current PCs. It was in this manner the Director of Administrative Data Processing suddenly found himself cast in the role of PC broker. An amount of roughly one third of the original purchase price was established as the price of a fully configured used Personal Computer. Those departments wishing PCs were excited at the prospects of obtaining a computer at that price. To safeguard the used PC buyer, all used PCs have one year of maintenance paid on the machines. The departments owning the PCs were elated at the possibility of upgrading their equipment at nearly the same original cost with a bonus down payment from the sale of their existing PCs. While the sale of used equipment has not reached large proportions, it has been successful in the eyes of all participants.

After two and one half years of existence, this fund has purchased over $200,000 worth of equipment for campus administrative departments and has a balance of more than $18,000. With those funds the campus has purchased forty-seven Personal Computers, three terminal controllers, five terminal multiplexors, upgraded the memory of thirty PCs in one of the campus' PC laboratories and procured several other miscellaneous items for use in the campus administrative computing effort. The equipment on rent today has a purchased value of $112,000. With statistics such as this, one must conclude, this initial investment of $70,000 has been effective for the Rolla campus.

In reflecting back on the arguments submitted to fund this project, the following observations could be made:

1. Upon his arrival to this campus the Chancellor observed the lack of computer terminals in existence in administrative offices. He did not state a terminal on every desk as a specific goal, but made clear his desire to significantly improve the situation. Through the implementation of this fund, the Rolla campus has greatly improved upon the ratio of computer devices per staff member.
2. While the Chancellor who established the fund is no longer in office on our campus, this fund has been successful enough that when our three and one half years have expired the current Chancellor could reclaim a sizeable portion of the original investment and the fund would still have some purchasing power.
3. The departments utilizing this fund have been able to upgrade their office equipment configuration without requesting additional funding and not one of the borrowing departments have submitted a request for funds to purchase additional Personal

Computers from campus special interest funds.

Since the inception of this program, our campus administrative users have had two options for purchasing departmental computers. The first option (specially funded, one-time purchases), has the advantage of utilizing one-time appropriations and does not create a permanent commitment to the campus budget. It also provides the potential for a greater number of devices to be purchased in a short period of time. However, this option has the distinct disadvantage of not addressing the long term needs of the departments. This satisfies short term needs only. In the long run the departments so funded will return to the funding office again ... and again ... and again. They are created as parasites to the campus special appropriation funds. Potentially, they may never have their equipment configuration modified again.

The self funded loan program provides a slower equipment growth path than the special funding approach. It also means the department's budget is potentially endangered in years where campus budgets are reduced. The directors are potentially faced with the problem of how to pay for their equipment should they have their budgets reduced. However, the loan fund approach means the department has an avenue to upgrade their equipment in an orderly fashion over the years. They can creatively manage their departmental budgets by the judicious use of this fund. This program provides a much healthier environment for the campus budget as a whole.

In weighing the pros and cons of the two approaches, it is my contention the advantages of the self funded loan program substantially outweigh those of the one-time appropriations. There is a sense of risk involved in that the director must gamble the departmental budget will not be reduced during the next forty-two months. However, the alternative approach presents the risk that funds will be available in the future to fund additional purchases. This latter approach relies totally on the good fortune that extra funds become available when the department needs them and that some person of relevance on the campus will be benevolent enough to grant the department the money the next time. It creates a continual line of people asking for special funding favors from key campus administrators. Universities simply can not operate with a yearly line of administrators requesting special funding favors like indigent in a bread line. Campus budgets must be properly planned and judiciously administered. However, departmental equipment needs must also be addressed if the campus is to keep abreast of the increasing work demands from internal and external sources. With an initial variable amount of one-time funds committed from the campus, the loan fund approach provides for a better managed equipment purchase policy and allows the University the potential to recover the loan with time. The self funded loan program is an investment in the future and one which creates a more stable budget situation for time to come.